FINAL DRAINAGE PLAN
SF 21-00X

SF-21-010

THE HILLS AT LORSON RANCH FIL. 1

JANUARY, 2021

PCD-ENGINEERING REVIEW COMMENTS IN BLUE BOXES WITH BLUE TEXT

Engineering Review
03/04/2021 8:23:23 AM
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Prepared for:

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Project No. 100.062

CORE
ENGINEERING GROUP

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ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Richard L. Schindler, P.E. #33997 Date
For and on Behalf of Core Engineering Group, LLC

OWNER'S STATEMENT

I, the Owner, have read and will comply with all the requirements specified in the drainage report and plan.

Lorson, LLC Date

By
Jeff Mark

Title
Manager

Address
212 N. Wahsatch Avenue, Suite 301, Colorado Springs, CO 80903

FLOODPLAIN STATEMENT

To the best of my knowledge and belief, this development is not located within a designated floodplain as shown on Flood Insurance Rate Map Panel No. and 08041C0976 G, dated December 7, 2018. (See Appendix A, FEMA FIRM Exhibit)

Richard L. Schindler, #33997 Date

EL PASO COUNTY

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volume 1 and 2, and Engineering Criteria Manual, As Amended.

Jennifer Irvine Date
County Engineer/ECM Administrator

Conditions: ____

1.0 LOCATION and DESCRIPTION

The Hills at Lorson Ranch Filing No. 1 is located east of the East Tributary of Jimmy Camp Creek. The site is located on approximately 123.169 acres of vacant land. This project will develop this site into single-family residential developments. The land for the residential lots is currently owned by Lorson LLC or its nominees for Lorson Ranch.

The site is located in the North 1/2 of Sections 24 and the South ½ of Section 13, Township 15 South and Range 65 West of the 6th Principal Meridian. The site is bounded on the north by unplatted land in Lorson Ranch, on the west by Lorson Ranch East Filing No. 3 and Filing No. 4, on the east by unplatted land in Lorson Ranch, and the south by unplatted land in Lorson Ranch. For reference, a vicinity map is included in Appendix A of this report.

Conformance with applicable Drainage Basin Planning Studies
There is an existing (unapproved) DBPS for Jimmy Camp Creek prepared by Wilson & Company in 1987, and is referenced in this report. The only major drainage improvements for this study area according to the 1987 Wilson study was the reconstruction of the East Tributary of Jimmy Camp Creek (East Tributary). In 2014 and in 2018 the East Tributary was reconstructed from downstream of Lorson Boulevard north to the northern property line of Lorson Ranch in accordance with the 1987 study. The last section of the East Tribuatary (to the south property line of Lorson Ranch) has been designed by Kiowa Engineering and will be completed in 2020. There are no further improvements to be made on the East Tributary. On March 9, 2015 a new DBPS for Jimmy Camp Creek and the East Tributary was completed by Kiowa Engineering. The Kiowa Engineering DBPS for Jimmy Camp Creek has not been adopted by El Paso County but is allowed for concept design. The concept design includes the East Tributary armoring concept and the full spectrum detention pond requirements. The Kiowa DBPS did not calculate drainage fees so current El Paso County drainage/bridge fees apply to this development.

Conformance with Lorson East MDDP by Core Engineering Group
Core Engineering Group has an approved MDDP for Lorson East which covers this study area. This PDR conforms to the MDDP for Lorson East and is referenced in this report. The major infrastructure to be constructed in this site includes Detention/WQ Ponds C1, C2.1, C2.2, C2.3, C3 and C4. Ponds C1 and C3 were graded in the Early Grading Plans for Lorson Ranch East under PUDSP-16-003. There are also two bridges over the East Tributary that were built in 2018 to provide access to this development across the East Tributary. The bridges are located at Fontaine Boulevard and Lorson Boulevard.

The Hills at Lorson Ranch is located within the ***"Jimmy Camp Creek Drainage Basin"***, which is a fee basin in El Paso County.

2.0 DRAINAGE CRITERIA

The supporting drainage design and calculations were performed in accordance with the City of Colorado Springs and El Paso County "Drainage Criteria Manual (DCM)", dated November, 1991, the El Paso County "Engineering Criteria Manual", Chapter 6 and Section 3.2.1 Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014, and the UDFCD "Urban Storm Drainage Criteria Manual" Volumes 1, 2 and 3 for inlet sizing and full spectrum ponds. No deviations from these published criteria are requested for this site.

The Rational Method as outlined in Section 6.3.0 of the May 2014 "Drainage Criteria Manual" and in Section 3.2.8.F of the El Paso County "Engineering Criteria Manual" was used for basins less than 130 acres to determine the rainfall and runoff conditions for the proposed development of the site. The runoff rates for the 5-year initial storm and 100-year major design storm were calculated.

Current updates to the Drainage Criteria manual for El Paso County states the if detention is necessary, Full Spectrum Detention will be included in the design, based on this criteria, Full Spectrum Detention will be required for this development.

3.0 EXISTING HYDROLOGICAL CONDITIONS

This site is currently undeveloped with native vegetation (grass with no shrubs) and moderate to steep slopes in a westerly direction the East Tributary of Jimmy Camp Creek.

The Soil Conservation Service (SCS) classifies the soils within the Lorson Ranch East property as Manzanola clay loam; Midway Clay Loam, Nelson-Tassel fine Sandy loam; Razor clay loam; and Wiley silt loam [3]. The sandy and silty loams are considered hydrologic soil group B soils with moderate to moderately rapid permeability. The Midway and Razor clay loams are considered hydrologic soil group C/D soils with slow permeability. All of these soils are susceptible to erosion by wind and water, have low bearing strength, moderate shrink-swell potential, and high frost heave potential (see table 3.1 below). The clay loams are difficult to vegetate and comprise of a small portion of the study area. These soils can be mitigated easily by limiting their use as topsoil since they comprise of a small portion of the study area. Weathered bedrock may be encountered beneath some of the site but it can be excavated using conventional techniques.

Table 3.1: SCS Soils Survey

Soil	Hydro. Group	Shrink/Swell Potential	Permeability	Surface Runoff Potential	Erosion Hazard
52-Manzanola Clay Loam	C	High	Slow	Medium	Moderate
54-Midway Clay Loam	D	High	Slow	Medium	Moderate
56-Nelson – Tassel Fine Sandy Loam	B	Moderate	Moderately Rapid	Slow	Moderate
75-Razor Clay Loam	C	High	Slow	Medium	Moderate
108-Wiley Silt Loam	B	Moderate	Moderate	Medium	Moderate

Excerpts from the SCS “Soil Survey of El Paso County Area, Colorado” are provided in ***Appendix A*** for further reference.

For the purpose of preparing hydrologic calculations for this report, the soil of each basin are assumed to be wholly comprised of the majority soil hydrologic group.

An existing electrical easement, with existing transmission towers, is located west side of this site and will be set aside as open space. It is the intent to utilize some of the open space under the towers for detention of storm flow.

This site is not located within the delineated 100-year floodplain of the East Tributary of Jimmy Camp Creek per the Federal Emergency Management Agency (FEMA) Flood Rate Insurance Map (FIRM) number 08041C10976 G, effective December 7, 2018.

Basin C1.1-ex

This existing basin consists of existing flow from undeveloped areas east of the PUD boundary. Runoff flows overland to the west and drains into Existing Pond C1 excavated as part of Lorson Ranch East Filing No. 4 grading. The existing runoff is 3.2cfs and 21cfs for the 5-year and 100-year events.

Basin C1.2-ex

This existing basin consists of existing flow from undeveloped areas east of the electric transmission line. Runoff flows overland to the west and drains into Existing Pond C1 excavated as part of Lorson Ranch East Filing No. 4 grading. The existing runoff is 10.6cfs and 71.2cfs for the 5-year and 100-year events.

Design Point 1x

Design Point 1x is the total existing flow entering Existing Pond C1. Existing Pond C1 was excavated as part of Lorson Ranch East Filing No. 4 grading and includes an 18" RCP pipe outlet. The existing runoff is 11.7cfs and 78.8cfs for the 5-year and 100-year events.

Basin C2.1-ex

This existing basin consists of existing flow from undeveloped areas east of the PUD boundary. Runoff flows overland to the west and drains to Design Point 2x at the east end of Fontaine Boulevard where an existing 54" pipe collects the flow. The existing runoff is 6.1cfs and 40.2cfs for the 5-year and 100-year events.

Basin C2.2-ex

This existing basin consists of existing flow from undeveloped areas east of the PUD boundary. Runoff flows overland to the west and drains to Design Point 2x at the east end of Fontaine Boulevard where an existing 54" pipe collects the flow. The existing runoff is 12.2cfs and 81.8cfs for the 5-year and 100-year events.

Basin C2.3-ex

This existing basin consists of existing flow from undeveloped areas east of the electric transmission liens. Runoff flows overland to the west and drains to Design Point 2x at the east end of Fontaine Boulevard where an existing 54" pipe collects the flow. The existing runoff is 7.9cfs and 45.7cfs for the 5-year and 100-year events.

Basin C2.4-ex

This existing basin consists of existing flow from undeveloped areas east of the electric transmission liens. Runoff flows overland to the west and drains to Design Point 2x at the east end of Fontaine Boulevard where an existing 54" pipe collects the flow. The existing runoff is 3.8cfs and 20.5cfs for the 5-year and 100-year events.

Design Point 2x

Design Point 2x is the total existing flow entering an existing 54" RCP storm sewer at the east end of Fontaine Boulevard. The 54" RCP was constructed as part of Lorson Ranch East Filing No. 1 early grading. The existing runoff is 24.8cfs and 155.1cfs for the 5-year and 100-year events.

Basin C3.1-ex

This existing basin consists of existing flow from undeveloped areas east of the PUD boundary. Runoff flows overland to the west and drains into Existing Pond C3 excavated as part of Lorson Ranch East Filing No. 2 final grading. The existing runoff is 2.6cfs and 15.0cfs for the 5-year and 100-year events.

Basin C3.2-ex

This existing basin consists of existing flow from undeveloped areas east of the electric transmission lines. Runoff flows overland to the west and drains into Existing Pond C3 excavated as part of Lorson Ranch East Filing No. 2 final grading. The existing runoff is 7.5cfs and 40.2cfs for the 5-year and 100-year events.

Design Point 3x

Design Point 3x is the existing flow entering Existing Pond C3 from Basins C3.1-ex and C3.2-ex. Existing Pond C3 was excavated as part of Lorson Ranch East Filing No. 2 final grading and includes a 24” RCP pipe outlet. The existing runoff is 7.7cfs and 42.4cfs for the 5-year and 100-year events from these two basins.

Basin C4.1-ex

This existing basin consists of existing flow from offsite undeveloped areas east of Lorson Ranch. Runoff flows overland to the west to the existing electric transmission lines and then drains south into Existing Pond C3 excavated as part of Lorson Ranch East Filing No. 2 final grading. The existing runoff is 1.2cfs and 8.0cfs for the 5-year and 100-year events.

Basin C4.2-ex

This existing basin consists of existing flow from undeveloped areas east of the PUD boundary. Runoff flows overland to the west to the existing electric transmission lines and then drains south into Existing Pond C3 excavated as part of Lorson Ranch East Filing No. 2 final grading. The existing runoff is 15.0cfs and 85.1cfs for the 5-year and 100-year events.

Design Point 4x

Design Point 4x is the existing flow at the electric transmission lines from Basins C4.1-ex and C4.2-ex. The existing runoff is 15.3cfs and 87.7cfs for the 5-year and 100-year events from these two basins. This flow is then routed south into Existing Pond C3.

Basin C5.1-ex

This existing basin consists of existing flow from offsite undeveloped areas north of Lorson Ranch. Runoff flows overland to the south to the existing electric transmission lines and then drains south into Existing Pond C3 excavated as part of Lorson Ranch East Filing No. 2 final grading. The existing runoff is 1.6cfs and 9.6cfs for the 5-year and 100-year events.

Basin C5.2-ex

This existing basin consists of existing flow from undeveloped areas north of the PUD boundary. Runoff flows overland to the south to the existing electric transmission lines and then drains south into Existing Pond C3 excavated as part of Lorson Ranch East Filing No. 2 final grading. The existing runoff is 3.2cfs and 21.8cfs for the 5-year and 100-year events.

Design Point 5x

Design Point 5x is the existing flow at the electric transmission lines from Basins C5.1-ex and C5.2-ex. The existing runoff is 4.2cfs and 27.2cfs for the 5-year and 100-year events from these two basins. This flow is then routed south into Existing Pond C3.

Basin C6-ex and Design Point 6x

This existing basin consists of existing flow from undeveloped areas west of the electric transmission lines. Runoff flows overland to the west to Lamprey Drive then drains south into an existing 15’ Type R inlet constructed as part of Lorson Ranch East Filing No. 3. The existing runoff is 6.3cfs and 35.6cfs for the 5-year and 100-year events.

Basin D1-ex

This existing basin consists of existing flow from undeveloped areas southeast of the PUD boundary. Runoff flows overland to the west to Lorson Boulevard into an existing temporary sediment basin constructed as part of Lorson Ranch East Filing No. 1. The existing runoff is 2.6cfs and 17.5cfs for the 5-year and 100-year events.

Basin D2-ex

This existing basin consists of existing flow from undeveloped areas east of the electric transmission lines north of Lorson Boulevard. Runoff flows overland to the west to Lorson Boulevard into an existing temporary sediment basin constructed as part of Lorson Ranch East Filing No. 1. The existing runoff is 1.5cfs and 10.1cfs for the 5-year and 100-year events.

Design Point 7x
Design Point 7x is the existing flow at the electric transmission lines from Basins D1-ex and D2-ex. The existing runoff is 3.9cfs and 26.4cfs for the 5-year and 100-year events from these two basins and drains into an existing temporary sediment basin and 36" RCP in Lorson Boulevard constructed as part of Lorson Ranch East Filing No. 1

4.0 DEVELOPED HYDROLOGICAL CONDITIONS

Hydrology for the **The Hills at Lorson Ranch** drainage report was based on the City of Colorado Springs/El Paso County Drainage Criteria. Sub-basins that lie within this project were determined and the 5-year and 100-year peak discharges for the developed conditions have been presented in this report. Based on these flows, storm inlets will be added when the street capacity is exceeded.

Soil type B/C/D has been assumed for the developed hydrologic conditions. See Appendix A for SCS Soils Map.

The time of concentration for each basin and sub-basin was developed using an overland, ditch, street and pipe flow components. The maximum overland flow length for developed conditions was limited to 100 feet. Travel time velocities ranged from 2 to 6 feet per second. The travel time calculations are included in the back of this report.
Runoff coefficients for the various land uses were obtained from Table 6-6 dated May, 2014 from the updated City of Colorado Springs/El Paso County Drainage Criteria Manual. See Appendix B.

Drainage concepts for each of the basins are briefly discussed as follow:

Basin C1.1
This basin consists of runoff from future residential development and Walleye Drive. Runoff will be directed west to Walleye Drive, then south to Design Point 1 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 2.5cfs and 5.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C1.2
This basin consists of runoff from future residential development and Walleye Drive. Runoff will be directed west to Walleye Drive, then to Design Point 1 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 2.3cfs and 5.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C1.3
This basin consists of runoff from future residential development and the future Lorson Boulevard east of Walleye Dr. Runoff will be directed to the future Lorson Boulevard, then west to Design Point 1a in future curb/gutter. The future developed flow from this basin is 16.3cfs and 35.9cfs for the 5/100-year storm event. A portion of this future flow will be allowed to flow to Design Point 1. See design point discussions. See the appendix for detailed calculations.

Basin C1.4
This basin consists of runoff from future residential development northeast of Walleye Dr./Lorson Blvd. Runoff will be directed southwest to Design Point 1a by a future storm sewer sized to handle the entire 100-year storm event from this basin. The future developed flow from this basin is 8.8cfs and 19.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C1.5

This basin consists of runoff from the west side of Walleye Drive. Runoff will be directed south to Design Point 1b in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 1.3cfs and 2.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C1.6</u>
This basin consists of runoff from future residential development southeast of Walleye Dr./Lorson Blvd at Design Point 1c. Runoff will be directed north to Design Point 1a by a future storm sewer sized to handle a portion of the 100-year storm event from this basin. The remaining runoff will continue west in a future street to Design Point 3. The future developed flow from this basin is 12.8cfs and 28.3cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C1.7</u>
This basin consists of runoff from future residential development and Lorson Blvd. Runoff will be directed north to Lorson Boulevard, then west in curb/gutter to Design Point 3 where it will be collected by a future Type R inlet. The developed flow from this basin is 5.4cfs and 11.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C1.8</u>
This basin consists of runoff from future residential development south of Lorson Blvd. Runoff will be directed west in future streets then north to Design Point 3 where it will be collected by a future Type R inlet. The developed flow from this basin is 8.1cfs and 17.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C2.1</u>
This basin consists of runoff from residential development and Pikeminnow Place. Runoff will be directed west to Design Point 5a in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 3.3cfs and 7.3cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C2.2</u>
This basin consists of runoff from residential development and Saugeye Street. Runoff will be directed west to Design Point 5d in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 6.1cfs and 13.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C2.3</u>
This basin consists of runoff from residential development and Saugeye Street. Runoff will be directed west to Wiper Way, then north to Design Point 5 in curb/gutter. The developed flow from this basin is 8.0cfs and 17.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C2.4</u>
This basin consists of runoff from residential development and Splake Street. Runoff will be directed west to Design Point 6 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 5.6cfs and 12.3cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C2.5</u>
This basin consists of runoff from residential development and Pikeminnow Place. Runoff will be directed west to Design Point 5b in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 9.3cfs and 20.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C2.6</u>
This basin consists of runoff from residential development and Wiper Way. Runoff will be directed north to Design Point 7 in curb/gutter where it will be collected by a Type R inlet. The developed flow

from this basin is 0.9cfs and 1.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C2.7

This basin consists of runoff from residential development and Splake Street. Runoff will be directed west to Design Point 7 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 5.8cfs and 12.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C2.8

This basin consists of runoff from residential development and Shadbush Lane. Runoff will be directed west to Design Point 9 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 3.4cfs and 7.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C2.9

This basin consists of runoff from residential development and Lake Trout Drive. Runoff will be directed west to Design Point 9 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 4.5cfs and 9.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C2.10

This basin consists of runoff from residential development and Shadbush Lane. Runoff will be directed west to Design Point 10a in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 2.8cfs and 6.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C2.11

This basin consists of runoff from residential development, open space under the electric transmission lines, and from existing Pond C1. Runoff will flow overland directly to existing Pond C1. The developed flow from this basin is 5.2cfs and 16.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Overall Basin C2

This basin is the overall flow from the C2 basins which flow to existing Pond C1. The developed flow from this overall 36.3ac basin is 39.4cfs and 90.7cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C3.1

This basin consists of runoff from future residential development located east of Walleye Drive. Runoff will flow north and west to Design Point 13a at Lake Trout Drive in future streets. A portion of the runoff will be collected by future inlets at this design point and the remaining runoff will continue north in a future street to Design Point 13b. The future developed flow from this basin is 75.9cfs and 167.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C4.1

This basin consists of runoff from future residential development and future Fontaine Boulevard located east of Walleye Drive and south of Fontaine Boulevard. Runoff will flow north to Design Point 12a located at Fontaine Boulevard in future streets. A portion of the runoff will be collected by future inlets at this design point and the remaining runoff will continue north in Fontaine Boulevard to Design Point 12. The future developed flow from this basin is 6.8cfs and 14.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C4.2

This basin consists of runoff from future residential development and future Fontaine Boulevard located east of Walleye Drive and south of Fontaine Boulevard. Runoff will flow north to Fontaine Boulevard, then west in the future Fontaine Boulevard to future inlets at Design Point 12. A portion of the runoff will be collected by future inlets at this design point and the remaining runoff will continue downstream to Design Point 13. The future developed flow from this basin is 6.7cfs and 14.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C4.3
This basin consists of runoff from future residential development located east of Walleye Drive. Runoff will flow north to Design Point 13b in future streets. The runoff will be collected by storm sewer and future inlets/pipes/manholes at this design point. The future developed flow from this basin is 4.3cfs and 9.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C4.4
This basin consists of runoff from future residential development located east of Walleye Drive and Walleye Drive. Runoff will flow west and north to Design Point 13 in Walleye Drive and will be collected by a Type R inlet. The developed flow from this basin is 5.7cfs and 12.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C4.5
This basin consists of runoff from residential development located west of Walleye Drive and Walleye Drive. Runoff will flow east and north to Design Point 13e in Walleye Drive and will be collected by a Type R inlet. The developed flow from this basin is 2.9cfs and 5.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C4.6
This basin consists of runoff from residential development located west of Walleye Drive and Pond C2.1. Runoff will flow overland directly to Pond C2.1. The developed flow from this basin is 4.3cfs and 14.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C5.1
This basin consists of runoff from future residential development located east of Walleye Drive and north of Fontaine Boulevard. Runoff will flow southwest to Design Point 16a at Fontaine Boulevard and will be collected by a storm sewer stub and future inlets/manholes. The developed flow from this basin is 42.3cfs and 92.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C5.2
This basin consists of runoff from future residential development located east of Walleye Drive. Runoff will flow west to Walleye Drive then south to Design Point 16 and will be collected by a Type R inlet. The developed flow from this basin is 3.7cfs and 8.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C5.3
This basin consists of runoff from future residential development and future Fontaine Boulevard. Runoff will flow south to Fontaine Boulevard then west to Design Point 16 and will be collected by a Type R inlet. The developed flow from this basin is 4.2cfs and 9.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C5.4
This basin consists of runoff from the west side of Walleye Drive. Runoff will flow to Walleye Drive then south to Design Point 17 and will be collected by a Type R inlet. The developed flow from this basin is 3.4cfs and 6.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C5.5

This basin consists of runoff from residential development and Fontaine Boulevard. Runoff will flow south to Fontaine Boulevard then west to Design Point 19 and will be collected by a Type R inlet. The developed flow from this basin is 4.7cfs and 10.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C6.1</u>
This basin consists of runoff from residential development and Lake Trout Drive. Runoff will be directed northwest to Design Point 20 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 2.7cfs and 6.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C6.2</u>
This basin consists of runoff from residential development and Rushpink Street. Runoff will be directed west to Design Point 20 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 6.4cfs and 14.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C6.3</u>
This basin consists of runoff from residential development, Kitfox Court, and Rushpink Street. Runoff will be directed north and west to Design Point 21 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 1.1cfs and 2.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C6.4</u>
This basin consists of runoff from residential development, Palafoxia Place, and Rushpink Street. Runoff will be directed north and west to Design Point 22 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 6.8cfs and 15.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C6.5</u>
This basin consists of runoff from residential development and Palafoxia Place. Runoff will be directed north to Design Point 22 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 0.7cfs and 1.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C6.6</u>
This basin consists of runoff from the south side of Fontaine Boulevard west of Walley Drive. Runoff will flow west in Fontaine Boulevard to Design Point 23a and will be collected by a Type R inlet. The developed flow from this basin is 6.4cfs and 11.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C6.7</u>
This basin consists of runoff from residential development, open space under the electric transmission lines, and from Pond C2.3. Runoff will flow overland directly to Pond C2.3. The developed flow from this basin is 4.7cfs and 13.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

<u>Basin C7.1</u>
This basin consists of runoff from residential development, Sanderling Street, and Whistling Duck Way. Runoff will be directed south and west to Design Point 26 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 5.0cfs and 11.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C7.2
This basin consists of runoff from residential development, Big Bird Drive, and Whistling Duck Way. Runoff will be directed west and south to Design Point 26 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 1.7cfs and 3.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C7.3
This basin consists of runoff from residential development, Godwit Lane, and Piping Plover Place. Runoff will be directed west and south to Design Point 26 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 1.7cfs and 3.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C7.4
This basin consists of runoff from residential development, Godwit Lane, and Piping Plover Place. Runoff will be directed north and west to Design Point 27 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 4.7cfs and 10.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C7.5
This basin consists of runoff from residential development and Big Bird Drive. Runoff will be directed south to Design Point 27 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 1.1cfs and 2.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C7.6
This basin consists of runoff from residential development, open space under the electric transmission lines, and from Pond C2.2. Runoff will flow overland directly to Pond C2.2. The developed flow from this basin is 3.9cfs and 15.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C8.1
This basin consists of runoff from future residential development located east of Walleye Drive at Sanderling Street. Runoff will flow to Design Point 31a at Sanderling Street in future streets. A portion of the runoff will be collected by future inlets at this design point and the remaining runoff will continue north in a future street to Design Point 31. The future developed flow from this basin is 13.9cfs and 30.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C8.2
This basin consists of runoff from future residential development and the east side Walleye Drive. Runoff will flow west and north to Design Point 31 in Walleye Drive and will be collected by a Type R inlet. The developed flow from this basin is 4.5cfs and 10.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C8.3
This basin consists of runoff from future residential development located northeast of Walleye Drive and Grayling Drive. Runoff will flow to Design Point 30 in future streets. A portion of the runoff will be collected by future inlets at this design point and the remaining runoff will continue south in future Walleye Drive to Design Point 31. The future developed flow from this basin is 23.0cfs and 50.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C8.4
This basin consists of runoff from future residential development east of Walleye Drive and Grayling Drive. Runoff flows west and a portion of the runoff will be collected by future inlets at Design Point 31b and the remaining runoff will continue south in a future street to Design Point 31a. The developed flow

from this basin is 13.2cfs and 29.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C8.5
This basin consists of runoff from future residential development located northeast of Walleye Drive and Grayling Drive. Runoff will flow to Design Point 33 at Scrub Jay Trail and Grayling Drive. The future developed flow from this basin is 7.4cfs and 16.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C8.6
This basin consists of runoff from the west side of Walleye Drive and the north side of Grayling Drive. Runoff will flow west to Design Point 33 at Scrub Jay Trail and Grayling Drive. The developed flow from this basin is 3.6cfs and 6.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C8.7
This basin consists of runoff from future residential development located north of Grayling Drive and Scrub Jay Trail. Runoff will flow south to Design Point 33 in future streets. A portion of the runoff will be collected by future inlets at this design point and the remaining runoff will continue west to Design Point 34. The future developed flow from this basin is 30.9cfs and 69.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C8.8
This basin consists of runoff from future residential development, Pond C4, and open space under the electric transmission line located northwest of Grayling Drive and Scrub Jay Trail. Overland runoff will flow south directly to Pond C4. The future developed flow from this basin is 5.9cfs and 21.8 cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.1
This basin consists of runoff from residential development, Wigeon Way, Walleye Drive, and Grayling Drive. Runoff will be directed west to Design Point 36 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 6.1cfs and 13.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.2
This basin consists of runoff from residential development, Wigeon Way, and Scrub Jay Trail. Runoff will be directed west to Design Point 36 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 1.1cfs and 2.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.3
This basin consists of runoff from residential development and Big Bird Drive. Runoff will be directed north to Design Point 36 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 0.6cfs and 1.3cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.4
This basin consists of runoff from residential development and Big Bird Drive. Runoff will be directed west to Design Point 36a in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 5.2cfs and 11.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.5
This basin consists of runoff from residential development and the south side of Grayling Drive. Runoff will be directed northwest to Design Point 40 in curb/gutter where it will be collected by a Type R inlet.

The developed flow from this basin is 1.8cfs and 4.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.6

This basin consists of runoff from the north side of Grayling Drive. Runoff will be directed west to Design Point 39 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 1.3cfs and 3.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.7

This basin consists of runoff from future residential development northeast of Grayling Drive and Lamprey Drive. Runoff will be directed southwest to Design Point 38 in curb/gutter and will continue flowing south in Grayling Drive to Design Point 39 where it will be collected by a Type R inlet. The developed flow from this future basin is 5.0cfs and 11.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.8

This basin consists of runoff from future residential development and an existing water pumpstation north of Grayling Drive. Runoff will be directed south overland to Design Point 39 where it will be collected by a Type R inlet. The developed flow from this future basin is 3.4cfs and 7.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.9

This basin consists of runoff from future residential development and open space under the electric transmission line north of Grayling Drive. Runoff will be directed south overland to Design Point 39 where it will be collected by a Type R inlet. The developed flow from this future basin is 5.9cfs and 13.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.10

This basin consists of runoff from future residential development northeast of Grayling Drive and Lamprey Drive. Runoff will be directed southwest to Design Point 38a in future curb/gutter where it will be collected by a Type R inlet. Flows from this basin will be directed in storm sewer to Pond C4. The developed flow from this future basin is 11.5cfs and 25.3cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C10.11

This basin consists of runoff from residential development, open space under the electric transmission lines, and from Pond C3. Runoff will flow overland directly to Pond C3. The developed flow from this basin is 9.6cfs and 31.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.1

This basin consists of runoff from residential development and Yellowthroat Terrace. Runoff will be directed west to Design Point 41 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 2.4cfs and 5.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.2

This basin consists of runoff from residential development, House Finch Lane, and Bufflehead Lane. Runoff will be directed northwest to Design Point 42 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 5.0cfs and 11.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.3

This basin consists of runoff from residential development and Bufflehead Lane. Runoff will be directed northwest to Design Point 42 in curb/gutter where it will be collected by a Type R inlet. The developed flow from this basin is 1.6cfs and 3.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.4

This basin consists of runoff from residential development and the west side of Murrelet Drive. Runoff will be directed north to Design Point 43. The developed flow from this basin is 3.0cfs and 6.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.5

This basin consists of runoff from residential development, the west side of House Finch Lane and the north side of Bobolink Terrace. Runoff will be directed north to Design Point 43. The developed flow from this basin is 4.3cfs and 9.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.6

This basin consists of runoff from residential development and the east side of Murrelet Drive. Runoff will be directed north to Design Point 44. The developed flow from this basin is 3.9cfs and 8.7cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.7

This basin consists of runoff from residential development and Anhinga Court. Runoff will be directed north to Design Point 44. The developed flow from this basin is 3.5cfs and 7.7cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.8

This basin consists of runoff from the south side of Lamprey Drive. Runoff will be directed southwest to Design Point 44. The developed flow from this basin is 2.1cfs and 3.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.9

This basin consists of runoff from the south side of Lamprey Drive. Runoff will be directed west to an existing 15' type R inlet at Design Point 45a. The developed flow from this basin is 1.0cfs and 2.3cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.10

This basin consists of runoff from open space and backyards of residential development south of Lamprey Drive. Runoff will be directed north to Design Point 46. The developed flow from this basin is 2.0cfs and 4.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C12.11

This basin consists of runoff from open space west of House Finch Lane. Runoff is already directed west to Grand Mountain School. The developed flow from this basin is 1.9cfs and 4.1cfs for the 5/100-year storm event and is the same as existing conditions. See the appendix for detailed calculations.

Basin D1.1

This basin consists of runoff from future residential development south of Lorson Blvd. Runoff will be directed north in future streets to Design Point 47a south of Lorson Boulevard at a future Type R inlet. The developed flow from this basin is 4.6cfs and 10.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D1.2

This basin consists of runoff from future residential development south of Lorson Blvd. Runoff will be directed north in future streets to Design Point 47b south of Lorson Boulevard at a future Type R inlet. The developed flow from this basin is 5.9cfs and 13.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D1.3
This basin consists of runoff from the south side of Lorson Blvd. Runoff and will be directed west to Design Point 47c at a Type R inlet. The developed flow from this basin is 3.2cfs and 6.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D1.4
This basin consists of runoff from the north side of Lorson Blvd, backyard runoff, and open space runoff. Runoff and will be directed south to Design Point 47d at a Type R inlet. The developed flow from this basin is 3.5cfs and 7.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D1.5
This basin consists of runoff south of Lorson Blvd from future backyards and open space runoff under the electric transmission line. Runoff and will be directed north to Design Point 47e at a Type R inlet in Lorson Boulevard. The developed flow from this basin is 2.6cfs and 9.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D1.6
This basin consists of runoff from Lorson Blvd and open space runoff under the electric transmission line. Runoff and will be directed south and west to an existing inlet at the NE corner of Lamprey Drive and Lorson Boulevard at Design Point 47f. The developed flow from this basin is 0.9cfs and 5.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

See the Developed Conditions Hydrology Calculations in the back of this report and the Developed Conditions Drainage Map (Map Pocket) for the 5-year and 100-year storm event amounts.

5.0 HYDRAULIC SUMMARY

The sizing of the hydraulic structures and detentions ponds were prepared by using the *StormSewers* and *Hydrographs* computer software programs developed by Intellisolve, which conforms to the methods outlined in the “City of Colorado Springs/El Paso County Drainage Criteria Manual”. Street capacities and Inlets were sized by Denver Urban Drainage’s xcel spreadsheet UD-Inlet.

It is the intent of this drainage report to use the proposed curb/gutter and storm sewer in the streets to convey runoff to detention and water quality ponds then to the East Tributary of Jimmy Camp Creek. Inlet size and location are preliminary only as shown on the storm sewer layout in the appendix. See Appendix C for detailed hydraulic calculations and the storm sewer model.

Table 1: Street Capacities (100-year capacity is only ½ of street)

	Residential Local		Residential Collector		Principal Arterial	
Street Slope	5-year	100-year	5-year	100-year	5-year	100-year
0.5%	6.3	26.4	9.7	29.3	9.5	28.5
0.6%	6.9	28.9	10.6	32.1	10.4	31.2
0.7%	7.5	31.2	11.5	34.6	11.2	33.7
0.8%	8.0	33.4	12.3	37.0	12.0	36.0
0.9%	8.5	35.4	13.0	39.3	12.7	38.2
1.0%	9.0	37.3	13.7	41.4	13.4	40.2
1.4%	10.5	44.1	16.2	49.0	15.9	47.6
1.8%	12.0	45.4	18.4	50.4	18.0	50.4
2.2%	13.3	42.8	19.4	47.5	19.5	47.5
2.6%	14.4	40.7	18.5	45.1	18.5	45.1
3.0%	15.5	39.0	17.7	43.2	17.8	43.2

3.5%	16.7	37.2	16.9	41.3	17.0	41.3
4.0%	17.9	35.7	16.2	39.7	16.3	29.7
4.5%	19.0	34.5	15.7	38.3	15.7	38.3
5.0%	19.9	33.4	15.2	37.1	15.2	37.1

Note: all flows are in cfs (cubic feet per second)

Design Point 1a

Design Point 1a is located south of Lorson Boulevard and Walleye Drive and flow is from future development from Basin C1.6. A future storm sewer will be constructed from the future Lorson Boulevard north to this design point. The total future flow is 12.8cfs/28.3cfs in the 5/100-year storm events for this basin. In the 5-year storm event 12cfs will be routed north to Design Point 1b (in pipe) and 0.8cfs will be routed to Design Point 3 (surface flow in street). In the 100-year storm event 20cfs will be routed north to Design Point 1b (in pipe) and 8.3cfs will be routed to Design Point 3 (surface flow in street).

Design Point 1b

Design Point 1b is located at the east end of Lorson Boulevard and accepts flows from future development from Basin C1.3 and Basin C1.4 and pipe flow from Des. Pt 1a. A 36" RCP storm sewer will be stubbed out to collect future flow at this design point. The total future flow is 37.1cfs/75.3cfs in the 5/100-year storm events for this basin. In the 5-year storm event 37.1cfs will flow into the 36" storm sewer stub via future inlets/manholes. In the 100-year storm event 9.9cfs will be routed north (surface flow) to Design Point 1, 0.1cfs will be routed to Design Point 1c, and 65.3cfs will flow into the 36" storm sewer stub via future inlets/manholes.

Design Point 1b (existing flows, interim condition)

In existing conditions, Basin C1.1-ex will generate 3.2cfs/21.4cfs in the 5/100-year storm events. Runoff will be directed to a 48" standpipe and temporary sediment basin at this design point. The standpipe will be connected to a 36" storm sewer in Lorson Boulevard.

Design Point 1

Design Point 1 is located at the NE corner of Lorson Boulevard and Walleye Drive and accepts flows from future development and from Walleye Drive. This inlet has been designed for ultimate development upstream which is a more conservative for inlets and storm sewer. The developed future conditions are as follows:

(5-year storm)

Tributary Basins: C1.1+C1.2 **Inlet/MH Number:** Inlet DP1
Upstream flowby: **Total Street Flow:** 4.8cfs

Flow Intercepted: 4.8cfs **Flow Bypassed:** 0
Inlet Size: 15' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 10.6cfs, okay

(100-year storm)

Tributary Basins: C1.1+C1.2 **Inlet/MH Number:** Inlet DP1
Upstream flowby: 9.9cfs from Des. Pt 1b **Total Street Flow:** 20.3cfs

Flow Intercepted: 20.3cfs **Flow Bypassed:**
Inlet Size: 15' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 32.1cfs (half street) is okay

Design Point 1c

Design Point 1c is located at the NW corner of Lorson Boulevard and Walleye Drive and accepts flows from Walleye Drive (Basin C1.5).

(5-year storm)
Tributary Basins: C1.5 **Inlet/MH Number:** Inlet DP1c
Upstream flowby: **Total Street Flow:** 1.3cfs

Flow Intercepted: 1.3cfs **Flow Bypassed:** 0
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 10.6cfs, okay

(100-year storm)
Tributary Basins: C1.5 **Inlet/MH Number:** Inlet DP1c
Upstream flowby: 0.1cfs from Des. Pt 1b **Total Street Flow:** 3.0cfs

Flow Intercepted: 3.0cfs **Flow Bypassed:**
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 32.1cfs (half street) is okay

Design Point 2 (ultimate development conditions)

Design Point 2 is the storm sewer pipe flow in Walleye Drive from Design Pt's 1 and 1c. The total pipe flow is 6.1cfs/23.3cfs in the 5/100-year storm events in the storm sewer.

Design Point 2a (ultimate development conditions)

Design Point 2a is the storm sewer pipe flow in Lorson Boulevard west of Walleye Drive from Design Pt's 1b and 2. The total pipe flow is 43.2cfs/88.6cfs in the 5/100-year storm events in the storm sewer.

Design Point 2a (interim condition)

Design Point 2a is the interim storm sewer pipe flow in Lorson Boulevard west of Walleye Drive from Design Pt. 1b (interim flow) and Design Pt. 2. The total interim pipe flow is (3.2+6.1)=9.3cfs in the 5-year storm event and (21.4+23.3)cfs= 44.7cfs in the 100-year storm event in the storm sewer. The storm sewer is designed for ultimate development conditions which is significantly more flow than interim conditions.

Design Point 3 (ultimate development conditions)
Design Point 3 is located at the SE corner of Lorson Boulevard and a future street (southwest of Brooktrout Tr) and accepts flows from Lorson Boulevard and from future development to the south and east.

(5-year storm)
Tributary Basins: C1.7+C1.8 **Inlet/MH Number:**
Upstream flowby: 0.8 from Des. Pt 1a **Total Street Flow:** 14.3cfs

Flow Intercepted: 14.3cfs **Flow Bypassed:** 0
Inlet Size: future inlets and manholes

Street Capacity: Street slope = 0.6%, capacity = 10.6cfs, okay since half is from south

(100-year storm)
Tributary Basins: C1.7+C1.8 **Inlet/MH Number:** Inlet DP1c
Upstream flowby: 8.3cfs from Des. Pt 1a **Total Street Flow:** 38.0cfs

Flow Intercepted: 38.0cfs **Flow Bypassed:**
Inlet Size: future inlets and manholes

Street Capacity: Street slope = 0.6%, capacity = 32.1cfs (half street) is okay since half is from south

Design Point 4 (Ultimate fully developed upstream)
Design Point 4 is the storm sewer pipe flow in Lorson Boulevard from Design Pt's 2a and 3. The total pipe flow is 57.5cfs/126.6cfs in the 5/100-year storm events in the storm sewer.

Design Point 5a
Design Point 5a is located on the east side of Wiper Way south of Saugeye Street

(5-year storm)
Tributary Basins: C2.1 **Inlet/MH Number:** Inlet DP5a
Upstream flowby: **Total Street Flow:** 3.3cfs

Flow Intercepted: 2.4cfs **Flow Bypassed:** 0.9cfs to Inlet DP6
Inlet Size: 5' type R, on-grade

Street Capacity: Street slope = 2.5%, capacity = 13.3cfs, okay

(100-year storm)
Tributary Basins: C2.1 **Inlet/MH Number:** Inlet DP5a
Upstream flowby: **Total Street Flow:** 7.3cfs

Flow Intercepted: 3.5cfs **Flow Bypassed:** 3.8cfs to Inlet DP6
Inlet Size: 5' type R, on-grade

Street Capacity: Street slope = 2.5%, capacity = 42.8cfs (half street) is okay

Design Point 5b

Design Point 5b is located on the west side of Wiper Way south of Saugeye Street

(5-year storm)
Tributary Basins: C2.5 **Inlet/MH Number:** Inlet DP5a
Upstream flowby: **Total Street Flow:** 9.3cfs

Flow Intercepted: 3.9cfs **Flow Bypassed:** 5.4cfs to Inlet DP7
Inlet Size: 5' type R, on-grade

Street Capacity: Street slope = 2.5%, capacity = 13.3cfs, okay

(100-year storm)
Tributary Basins: C2.5 **Inlet/MH Number:** Inlet DP5a
Upstream flowby: **Total Street Flow:** 20.5cfs

Flow Intercepted: 5.3cfs **Flow Bypassed:** 15.2cfs to Inlet DP7
Inlet Size: 5' type R, on-grade

Street Capacity: Street slope = 2.5%, capacity = 42.8cfs (half street) is okay

Design Point 5c

Design Point 5c is the storm sewer pipe flow in Wiper Way from Design Pt's 5a and 5b. The total pipe flow is 6.3cfs/8.8cfs in the 5/100-year storm events in the storm sewer.

Design Point 5d

Design Point 5d is located on the north side of Saugeye Street east of Wiper Way

(5-year storm)
Tributary Basins: C2.2 **Inlet/MH Number:** Inlet DP5a
Upstream flowby: **Total Street Flow:** 6.1cfs

Flow Intercepted: 5.4cfs **Flow Bypassed:** 0.7cfs to Des. Pt 5
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 1.1%, capacity = 9.0cfs, okay

(100-year storm)
Tributary Basins: C2.2 **Inlet/MH Number:** Inlet DP5a
Upstream flowby: **Total Street Flow:** 13.4cfs

Flow Intercepted: 8.4cfs **Flow Bypassed:** 5.0cfs to Des. Pt 5
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 1.1%, capacity = 37.3cfs (half street) is okay

Design Point 5
Design Point 5 is located on the east side of Wiper Way north of Saugeye Street and is the street flow on the east side of Wiper Way

(5-year storm)
Tributary Basins: C2.3 **Inlet/MH Number:**
Upstream flowby: 0.7cfs from Des.Pt 5d **Total Street Flow:** 8.7cfs

Flow Intercepted: **Flow Bypassed:**
Inlet Size:

Street Capacity: Street slope = 2%, capacity = 12.0cfs, okay

(100-year storm)
Tributary Basins: C2.3 **Inlet/MH Number:**
Upstream flowby: 5.0cfs from Des.Pt 5d **Total Street Flow:** 22.5cfs

Flow Intercepted: **Flow Bypassed:**
Inlet Size:

Street Capacity: Street slope = 2%, capacity = 45cfs (half street) is okay

Design Point 5e
Design Point 5e is the storm sewer pipe flow in Wiper Way from Design Pt's 5c and 5d. The total pipe flow is 11.7cfs/17.2cfs in the 5/100-year storm events in the storm sewer.

Design Point 6
Design Point 6 is located on the south side of Splake Street at a low point.

(5-year storm)
Tributary Basins: C2.4 **Inlet/MH Number:** Inlet DP6
Upstream flowby: 8.7cfs from Des.Pt 5 **Total Street Flow:** 14.3cfs

Flow Intercepted: 14.3cfs **Flow Bypassed:**
Inlet Size: 30' type R, sump

Street Capacity: Street slope = 3%, capacity = 15.5 cfs, okay

(100-year storm)
Tributary Basins: C2.4 **Inlet/MH Number:** Inlet DP6
Upstream flowby: 22.5cfs from Des.Pt 5 **Total Street Flow:** 34.8cfs

Flow Intercepted: 34.8cfs **Flow Bypassed:**
Inlet Size: 30' type R, sump

Street Capacity: Street slope = 3%, capacity = 39cfs (half street) is okay

Design Point 7

Design Point 7 is located on the north side of Splake Street at a low point.

(5-year storm)

Tributary Basins: C2.6 & C2.7 **Inlet/MH Number:** Inlet DP7

Upstream flowby: 5.4cfs from Des.Pt 5b **Total Street Flow:** 12.1cfs

Flow Intercepted: 12.1cfs **Flow Bypassed:**

Inlet Size: 25' type R, sump

Street Capacity: Street slope = 3%, capacity = 15.5 cfs, okay

(100-year storm)

Tributary Basins: C2.6 & C2.7 **Inlet/MH Number:** Inlet DP7

Upstream flowby: 15.2cfs from Des.Pt 5b **Total Street Flow:** 29.9cfs

Flow Intercepted: 29.9cfs **Flow Bypassed:**

Inlet Size: 25' type R, sump

Street Capacity: Street slope = 3%, capacity = 39cfs (half street) is okay

Design Point 8

Design Point 8 is the storm sewer pipe flow west of Splake Street from Design Pt's 5a, 5b, 5d, 6,&7. The total pipe flow is 38.1cfs/81.9cfs in the 5/100-year storm events in the storm sewer.

Design Point 8a

Design Point 8a is the storm sewer pipe flow into the southeast corner of Pond C1 from Splake Street from Design Pt's 4 & 8. The total pipe flow is 95.6cfs/208.5cfs in the 5/100-year storm events in the storm sewer.

Design Point 9

Design Point 9 is located on the east side of Kitfox Court at a low point south of Lake Trout Drive.

(5-year storm)

Tributary Basins: C2.8+C2.9 **Inlet/MH Number:** Inlet DP9

Upstream flowby: **Total Street Flow:** 7.9cfs

Flow Intercepted: 7.9cfs **Flow Bypassed:**

Inlet Size: 15' type R, sump

Street Capacity: Street slope = 1.5%, capacity = 10.5 cfs, okay

(100-year storm)

Tributary Basins: C2.8+C2.9 **Inlet/MH Number:** Inlet DP9

Upstream flowby: **Total Street Flow:** 17.2cfs

Flow Intercepted: 17.2cfs **Flow Bypassed:**

Inlet Size: 15' type R, sump

Street Capacity: Street slope = 1.5%, capacity = 44.1cfs (half street) is okay

Design Point 9a
Design Point 9a is located on the west side of Kitfox Court at a low point south of Lake Trout Drive.

(5-year storm)
Tributary Basins: C2.10 **Inlet/MH Number:** Inlet DP9a
Upstream flowby: **Total Street Flow:** 2.8cfs

Flow Intercepted: 2.8cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.5%, capacity = 10.5 cfs, okay

(100-year storm)
Tributary Basins: C2.10 **Inlet/MH Number:** Inlet DP9a
Upstream flowby: **Total Street Flow:** 6.2cfs

Flow Intercepted: 6.2cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.5%, capacity = 44.1cfs (half street) is okay

Design Point 10
Design Point 10 is the storm sewer pipe flow from Kitfox Court to Pond C1 from Design Pt's 9 and 9a. The total pipe flow is 10.7cfs/23.4cfs in the 5/100-year storm events in the storm sewer.

Design Point 11
Design Point 11 is the total developed flow into Pond C1 from the C1 basins and the C2 basins with a total area of 76acres. The total flow is 85.4cfs/192.4cfs in the 5/100-year storm events in the storm sewer using the Rational Method of runoff calculations and adding storm sewer flows (see xcel spreadsheet). These flow rates are slightly higher and more conservative than the peak inflow from the full spectrum pond spreadsheets (75.6cfs/170.4cfs in the 5/100-year storm events).

Design Point 11a
Design Point 11a is the total developed outflow from Pond C1 calculated using the Full Spectrum EDB Xcel design spreadsheet. The total outflow is 7.1cfs/18.1cfs in the 5/100-year storm events in the existing 18" storm sewer pipe constructed as part of Lorson Ranch East Filing No. 4. The outflow rates are similar to the allowable design flows in the Lorson Ranch East MDDP (4.0cfs/18.0cfs) and the Lorson Ranch East Filing No. 4 final drainage report.

Design Point 12a
Design Point 12a is located south of Fontaine Boulevard east of Walleye Drive and accepts flows from future development from Basin C4.1. A future storm sewer will be stubbed out to collect future flow at this design point and will convey it west to Design Point 12. The total future flow accepted is 6.8cfs/14.9cfs in the 5/100-year storm events in the storm sewer.

Design Point 12
Design Point 12 is located south of Fontaine Boulevard east of Walleye Drive and accepts flows from future development from Basin C4.2 and Design Point 12a. A future storm sewer will be stubbed out to collect a portion of the future flow at this design point and will convey it south to Design Point 13b. The remaining portion will flow south to Design Point 13 and will be collected by a Type R inlet. The total future flow is 13.5cfs/29.7cfs in the 5/100-year storm events in the storm sewer. It is estimated that 5.5cfs/12cfs in the 5/100-year storm events will be directed to Design Point 13 via curb/gutter. It is

estimated that 8.0cfs/17.7cfs in the 5/100-year storm events will be directed to Design Point 13b via a future storm sewer.

Design Point 13a (ultimate development conditions)
Design Point 13a is located south of Fontaine Boulevard east of Walleye Drive/Lake Trout Dr and accepts flows from future development from Basin C3.1. A storm sewer will be stubbed out from Walleye Drive to collect a portion of this future flow and will convey it north to Design Point 13d. The remaining flow will flow north in future streets to Design Point 13b. The total future flow is 75.9cfs/167.0cfs in the 5/100-year storm events in the storm sewer. It is estimated that 8.0cfs/30.0cfs in the 5/100-year storm events will be directed north to Design Point 13b via future curb/gutter. It is estimated that 69.7cfs/137cfs in the 5/100-year storm events will be directed to Walleye Drive and Design Point 13d via a 42” storm sewer stub in Walleye Drive. No flow will enter this storm sewer in interim conditions. Existing runoff from the east (Basin C2.2-ex) flows north/northwest to Design Point 13b where a storm sewer/standpipe/sediment basin captures the runoff.

Design Point 13b (ultimate development conditions)
Design Point 13b is located southeast corner of Fontaine Boulevard and Walleye Drive and accepts flows from future development from Basin C4.3, surface flowby from Design Point 13a (ultimate), and pipe flow from Design Point 12. A storm sewer will be stubbed out from Walleye Drive to collect this future flow and will convey it west to Design Point 13. It is estimated that 20.3cfs/57.1cfs in the 5/100-year storm events will be directed to Design Point 13 via a 42” storm sewer.

Design Point 13b (interim conditions)
Design Point 13b is located southeast corner of Fontaine Boulevard and Walleye Drive and accepts overland runoff from existing Basin C2.2-ex. Runoff flows overland in existing swales to this design point. A 42” storm sewer, 48” diameter standpipe, and temporary sediment basin will collect flows and convey them west in storm sewer to Design Point 13. In order to accommodate existing flow conditions, the 42” storm sewer has been oversized to accept 82cfs of existing flow from Basin C2.2-ex. The existing flow will enter the system via a 48” standpipe at this design point with a depth of 1.57’.

Design Point 13
Design Point 13 is located on the east side of Walleye Drive south of Fontaine Boulevard at a low point.

(5-year storm)
Tributary Basins: C4.4 **Inlet/MH Number:** Inlet DP13
Upstream flowby: 5.5cfs from Des.Pt.12 **Total Street Flow:** 11.2cfs

Flow Intercepted: 11.2cfs **Flow Bypassed:**
Inlet Size: 25’ type R, sump

Street Capacity: Street slope = 0.7%, capacity = 11.5 cfs, okay

(100-year storm)
Tributary Basins: C4.4 **Inlet/MH Number:** Inlet DP13
Upstream flowby: 12.0cfs from Des.Pt 12 **Total Street Flow:** 24.5cfs

Flow Intercepted: 24.5cfs **Flow Bypassed:**
Inlet Size: 25’ type R, sump

Street Capacity: Street slope = 0.7%, capacity = 34.6cfs (half street) is okay

Design Point 13c (ultimate development conditions)
Design Point 13c is the storm sewer pipe flow from Design Pt’s 13 and 13b. The total pipe flow is 31.5cfs/81.6cfs in the 5/100-year storm events in the storm sewer for ultimate development conditions.

Design Point 13c (interim conditions)
Design Point 13c is the flow from Design Pt's 13 and the interim flow from Design Point 13b. The total pipe flow is (11.2+12.2)=23.4cfs in the 5-year storm event and (24.5+81.8)=106.30cfs in the 100-year storm events in the storm sewer. This short section of storm sewer was upsized to a 42" diameter pipe at 1% slope which has a free-flow capacity of 107cfs.

Design Point 13d (ultimate development conditions)
Design Point 13d is the storm sewer pipe flow from Design Pt's 13a (ultimate) and 13c (ultimate) in future developed conditions. Future developed conditions produce significantly more runoff than un-developed interim conditions so the pipe was designed for the ultimate conditions. The total pipe flow is 101.2cfs/218.6cfs in the 5/100-year storm events in the storm sewer.

Design Point 13e
Design Point 13e is located on the west side of Walleye Drive south of Fontaine Boulevard at a low point.

(5-year storm)
Tributary Basins: C4.5 **Inlet/MH Number:** Inlet DP13e
Upstream flowby: **Total Street Flow:** 2.9cfs

Flow Intercepted: 2.9cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 0.7%, capacity = 11.5 cfs, okay

(100-year storm)
Tributary Basins: C4.5 **Inlet/MH Number:** Inlet DP13e
Upstream flowby: **Total Street Flow:** 5.2cfs

Flow Intercepted: 5.2cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 0.7%, capacity = 34.6cfs (half street) is okay

Design Point 14 (ultimate development conditions)
Design Point 14 is the storm sewer pipe flow from Design Pt's 13e and 13d that flow into Pond C2.1. The total pipe flow is 104.1cfs/223.8cfs in the 5/100-year storm events and will be used to size the storm sewer.

Design Point 15 (ultimate development conditions)
Design Point 15 is the total developed flow into Pond C2.1 from the C3 basins and the C4 basins with a total area of 74.5acres. The total flow is 85.6cfs/213.2cfs in the 5/100-year storm events in the storm sewer using the Rational Method of runoff calculations (see xcel spreadsheet). This number is slightly lower than Design Point 14 because this design point reduces flow for the increased time of concentration from the entire basin. These flow rates generally match the peak inflow from the full spectrum pond spreadsheets (91.4cfs/201.7cfs in the 5/100-year storm events)

Design Point 15a (ultimate development conditions)
Design Point 15a is the total future developed outflow from Pond C2.1 calculated using the Full Spectrum EDB Xcel design spreadsheet. The total outflow is 12.8cfs/65.0cfs in the 5/100-year storm events from the full spectrum outlet structure into a 30" storm sewer pipe outfall. The outflow rates are similar to the allowable design flows in the Lorson Ranch East MDDP (11.0cfs/63.3cfs) for Pond C2.1.

Design Point 15a (interim conditions)

The interim state assumes that there is no upstream development in the C3 and C4 basins and no full spectrum outlet structure. Runoff comes from existing Basin C2.2-ex into the storm system in a 48" standpipe at Design Point 13b and from Developed Basins C4.4, C4.5, & C4.6. Runoff will enter Pond C2.1, will be detained, and then released by a 30" storm sewer pipe located at the west end of the pond. Pond C2.1 in the interim state was modeled in hydraflow to make sure the outflow rates do not exceed the downstream 30" storm sewer capacity. The hydraflow model calculated the interim pond outflow into the 30" pipe outlet to be 11.42cfs/40.0cfs in the 5/100-year storm events which is less than the capacity of the designed downstream storm sewer system.

Design Point 16a

Design Point 16a is located in the NE of Fontaine Boulevard and Walleye Drive and accepts flows from future development from Basin C5.1. A storm sewer will be stubbed out from Fontaine Boulevard to collect all of this future flow and will convey it SW to Design Point 16a. The total future flow is 42.3cfs/92.5cfs in the 5/100-year storm events in the storm sewer. In the interim conditions a 48" standpipe and sediment basin will collect flow from existing Basin C2.1-ex at 6.1cfs/40.2cfs in the 5/100-year storm events which is less than the designed future flows.

Design Point 16

Design Point 16 is located in the NE corner of Fontaine Boulevard/Walleye Drive at a low point.

(5-year storm)

Tributary Basins: C5.2+C5.3 **Inlet/MH Number:** Inlet DP16
Upstream flowby: **Total Street Flow:** 7.9cfs

Flow Intercepted: 7.9cfs **Flow Bypassed:**
Inlet Size: 15' type R, sump

Street Capacity: Street slope = 0.7%, capacity = 11.5 cfs, okay

(100-year storm)

Tributary Basins: C5.2+C5.3 **Inlet/MH Number:** Inlet DP16
Upstream flowby: **Total Street Flow:** 17.7cfs

Flow Intercepted: 17.7cfs **Flow Bypassed:**
Inlet Size: 15' type R, sump

Street Capacity: Street slope = 0.7%, capacity = 34.6cfs (half street) is okay

Design Point 17
Design Point 17 is located in the NW corner of Fontaine Boulevard/Walleye Drive at a low point.

(5-year storm)
Tributary Basins: C5.4 **Inlet/MH Number:** Inlet DP17
Upstream flowby: **Total Street Flow:** 3.4cfs

Flow Intercepted: 3.4cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 0.7%, capacity = 11.5 cfs, okay

(100-year storm)
Tributary Basins: C5.4 **Inlet/MH Number:** Inlet DP17
Upstream flowby: **Total Street Flow:** 6.1cfs

Flow Intercepted: 6.1cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 0.7%, capacity = 34.6cfs (half street) is okay

Design Point 17a
Design Point 17a is the storm sewer pipe flow from Design Pt's 16 and 17. The total pipe flow is 11.3cfs/23.8cfs in the 5/100-year storm events in the storm sewer.

Design Point 18
Design Point 18 is the storm sewer pipe flow from Design Pt's 16a and 17a. The total pipe flow is 53.6cfs/116.3cfs in the 5/100-year storm events in the storm sewer.

Design Point 19
Design Point 19 is located on Fontaine Boulevard south of Pond C2.2

(5-year storm)
Tributary Basins: C5.5 **Inlet/MH Number:** Inlet DP19
Upstream flowby: **Total Street Flow:** 4.7 cfs

Flow Intercepted: 4.7cfs **Flow Bypassed:** 0cfs
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 3.0%, capacity = 17.7 cfs, okay

(100-year storm)
Tributary Basins: C5.5 **Inlet/MH Number:** Inlet DP19
Upstream flowby: **Total Street Flow:** 10.4cfs

Flow Intercepted: 9.7cfs **Flow Bypassed:** 0.7cfs
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 3.0%, capacity = 43.2cfs (half street) is okay

Design Point 19a

Design Point 19a is the storm sewer pipe flow from Design Pt's 18 and 19. The total pipe flow is 58.3cfs/126.0cfs in the 5/100-year storm events in the storm sewer.

Design Point 20

Design Point 20 is located on the south side of Rushpink Street east of Kitfox Court at a low point.

(5-year storm)
Tributary Basins: C6.1+C6.2
Inlet/MH Number: Inlet DP20
Upstream flowby:
Total Street Flow: 9.1cfs

Flow Intercepted: 9.1cfs
Flow Bypassed:
Inlet Size: 20' type R, sump

Street Capacity: Street slope = 1.8%, capacity = 12.0cfs, okay

(100-year storm)
Tributary Basins: C6.1+C6.2
Inlet/MH Number: Inlet DP20
Upstream flowby:
Total Street Flow: 20.1cfs

Flow Intercepted: 20.1cfs
Flow Bypassed:
Inlet Size: 20' type R, sump

Street Capacity: Street slope = 1.8%, capacity = 45.4cfs (half street) is okay

Design Point 21

Design Point 21 is located on the north side of Rushpink Street east of Kitfox Court at a low point.

(5-year storm)
Tributary Basins: C6.3
Inlet/MH Number: Inlet DP21
Upstream flowby:
Total Street Flow: 1.1cfs

Flow Intercepted: 1.1cfs
Flow Bypassed:
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 1.8%, capacity = 12.0cfs, okay

(100-year storm)
Tributary Basins: C6.3
Inlet/MH Number: Inlet DP21
Upstream flowby:
Total Street Flow: 2.4cfs

Flow Intercepted: 2.4cfs
Flow Bypassed:
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 1.8%, capacity = 45.4cfs (half street) is okay

Design Point 21a

Design Point 21a is the storm sewer pipe flow from Design Pt's 20 and 21. The total pipe flow is 10.2cfs/22.5cfs in the 5/100-year storm events in the storm sewer.

Design Point 22

Design Point 22 is located at the north end of Palafoxia Place at a low point.

(5-year storm)

Tributary Basins: C6.4+C6.5 **Inlet/MH Number:** Inlet DP22
Upstream flowby: **Total Street Flow:** 7.5cfs

Flow Intercepted: 7.5cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.4%, capacity = 10.5cfs, okay

(100-year storm)

Tributary Basins: C6.4+C6.5 **Inlet/MH Number:** Inlet DP22
Upstream flowby: **Total Street Flow:** 16.2cfs

Flow Intercepted: 16.2cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.4%, capacity = 44.1cfs (half street) is okay

Design Point 23

Design Point 23 is the storm sewer pipe flow from Design Pt's 15a (future Pond C2.1 outflow) and Design Point 22. The total pipe flow is 20.3cfs/81.2cfs in the 5/100-year storm events in the storm sewer.

Design Point 23a

Design Point 23a is located on Fontaine Boulevard north of Pond C2.3

(5-year storm)

Tributary Basins: C6.6 **Inlet/MH Number:** Inlet DP23a
Upstream flowby: **Total Street Flow:** 6.4cfs

Flow Intercepted: 6.4cfs **Flow Bypassed:**
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 3.0%, capacity = 17.7cfs, okay

(100-year storm)

Tributary Basins: C6.6 **Inlet/MH Number:** Inlet DP23a
Upstream flowby: **Total Street Flow:** 11.5cfs

Flow Intercepted: 10.4cfs **Flow Bypassed:** 1.1cfs
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 3.0%, capacity = 43.2cfs (half street) is okay

Design Point 24
Design Point 24 is the storm sewer pipe flow from Design Pt's 21a, 23, and Design Point 23a. The total pipe flow is 36.9cfs/114.1cfs in the 5/100-year storm events in the storm sewer.

Design Point 24a
Design Point 24a is the total developed flow into Pond C2.3 from the C6 basins and from Pond C2.1 outflow. The total inflow was calculated by the full spectrum Xcel worksheets by adding the CUHP hydrograph for the C6 basins to the Pond C2.1 outflow hydrograph (see appendix for hydrograph spreadsheet). The total inflow to Pond C2.3 is 20.7cfs/95.3cfs in the 5/100-year storm events (see xcel spreadsheet). This number is slightly lower than the design flows in the stormsewer (Design Point 24) and is due to adding cumulative storm sewer flows without adjusting for the time of concentration. This will result in a slightly more conservative storm sewer sizing.

Design Point 25
Design Point 25 is the total developed outflow from Pond C2.3 calculated using the Full Spectrum EDB Xcel design spreadsheet. The total outflow is 5.5cfs/64.9cfs in the 5/100-year storm events in the 30" storm sewer pipe. The outflow rates are higher than the flows in the Lorson Ranch East MDDP (4.5cfs/52cfs) for this pond. The 1.0cfs/18.1cfs over the flows allowed by the MDDP will be compensated by reducing the outflow from Pond C2.2 located north of Fontaine Boulevard. See Design Point 29a. Both of these ponds flow to an existing 54" storm sewer located in Fontaine Boulevard.

Design Point 25 (Emergency Overflow Conveyance)
As discussed in the Lorson Ranch East MDDP, Pond C2.3 will include a full spectrum pond outlet structure and an emergency overflow conveyance structure just downstream of the full spectrum pond. A 30" storm sewer from the full spectrum outlet structure will connect to the conveyance structure. The conveyance structure is a 20' CDOT Type R inlet with an 18" throat opening and 2' high concrete inflow apron from the spillway to the structure designed to handle 70cfs per the Fontaine Boulevard FDR (CDR183). A 42" RCP outflow pipe will connect the conveyance structure to the existing 54" storm sewer in Fontaine Boulevard. The existing 54" storm sewer extends west and drains into Pond C5 which drains into the East Tributary of Jimmy Camp Creek per the Lorson Ranch East Filing No. 1 FDR.

Design Point 26
Design Point 26 is located at the east side of Big Bird Drive and Piping Plover Place at a low point.

(5-year storm)
Tributary Basins: C7.1-C7.3 **Inlet/MH Number:** Inlet DP26
Upstream flowby: **Total Street Flow:** 10.8cfs

Flow Intercepted: 10.8cfs **Flow Bypassed:**
Inlet Size: 20' type R, sump

Street Capacity: Street slope = 1.5%, capacity = 10.9cfs, okay

(100-year storm)
Tributary Basins: C7.1-C7.3 **Inlet/MH Number:** Inlet DP26
Upstream flowby: **Total Street Flow:** 24.0cfs

Flow Intercepted: 24.0cfs **Flow Bypassed:**
Inlet Size: 20' type R, sump

Street Capacity: Street slope = 1.5%, capacity = 44.8cfs (half street) is okay

Design Point 27

Design Point 27 is located at the west side of Big Bird Drive and Piping Plover Place at a low point.

(5-year storm)

Tributary Basins: C7.4+C7.5 **Inlet/MH Number:** Inlet DP27

Upstream flowby: **Total Street Flow:** 5.6cfs

Flow Intercepted: 5.6cfs **Flow Bypassed:**

Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.5%, capacity = 10.9cfs, okay

(100-year storm)

Tributary Basins: C7.4+C7.5 **Inlet/MH Number:** Inlet DP27

Upstream flowby: **Total Street Flow:** 12.5cfs

Flow Intercepted: 12.5cfs **Flow Bypassed:**

Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.5%, capacity = 44.8cfs (half street) is okay

Design Point 28

Design Point 28 is the storm sewer pipe flow from Design Pt 26 and Design Point 27. The total pipe flow is 16.4cfs/36.5cfs in the 5/100-year storm events in the storm sewer.

Design Point 29

Design Point 29 is the total developed flow into Pond C2.2 from the C5 basins, C7 basins, and from Pond C3 outflow. The total inflow was calculated by the full spectrum Xcel worksheets by adding the CUHP hydrograph for the C5+C7 basins to the Pond C3 outflow hydrograph (see appendix for hydrograph spreadsheet). The total inflow to Pond C2.2 is 59.5cfs/131.3cfs in the 5/100-year storm events (see xcel spreadsheet).

Design Point 29a

Design Point 29a is the total developed outflow from Pond C2.2 calculated using the Full Spectrum EDB Xcel design spreadsheet. The total outflow is 2.7cfs/42.9cfs in the 5/100-year storm events in the 30" storm sewer pipe. The outflow rates are lower than the flows in the Lorson Ranch East MDDP (6cfs/61cfs) for this pond. The 3.3cfs/18.1cfs reduction in the pond release rate will compensate for the Pond C2.3 higher release rates. See Design Point 25. Both of these ponds flow to an existing 54" storm sewer located in Fontaine Boulevard.

Design Point 29a (Emergency Overflow Conveyance)

As discussed in the Lorson Ranch East MDDP, Pond C2.2 will include a full spectrum pond outlet structure and an emergency overflow conveyance structure just downstream of the full spectrum pond. A 30" storm sewer from the full spectrum outlet structure will connect to the conveyance structure. The conveyance structure is a 25' CDOT Type R inlet with an 18" throat opening and 2' high concrete inflow apron from the spillway to the structure designed to handle 130cfs per the Fontaine Boulevard FDR (CDR183) A 48" RCP outflow pipe will connect the conveyance structure to the existing 54" storm sewer in Fontaine Boulevard.

Design Point 30

Design Point 30 is located north of Walleye Drive/Grayling Drive and accepts flows from future development from Basin C8.3, C8.5, and C4.1-ex. A storm sewer will be stubbed out from Walleye Drive to collect a portion of this future flow and will convey it south in storm sewer to Design Point 32. The remaining flow will flow south in the future street to Design Point 31. The total future flow is 24.3cfs/59.4cfs in the 5/100-year storm events. It is estimated that 5.0cfs/10.0cfs in the 5/100-year storm events will be directed south to Design Point 31 via future curb/gutter. It is estimated that 19.3cfs/49.4cfs in the 5/100-year storm events will be directed south to Design Point 32 via a 30" storm sewer stub from Walleye Drive/Grayling Drive. Interim existing flows (prior to grading) from Basin C4.2ex will flow west overland to a temporary sediment basin at Design Point 34.

Design Point 31a

Design Point 31a is located north of Fontaine Boulevard at the NE corner of Walleye Drive/Sanderling Street and accepts flows from future development from Basin C8.1. A storm sewer will be stubbed out from Walleye Drive to collect the future flow and will convey it north in storm sewer to Design Point 31c. The remaining flow will flow north in the east side of Walleye Drive via curb/gutter to Design Point 31. The total future flow is 13.9cfs/30.9cfs in the 5/100-year storm events in the storm sewer. It is estimated that 5.0cfs/10.0cfs in the 5/100-year storm events will be directed north to Design Point 31 via curb/gutter. It is estimated that 8.9cfs/20.9cfs in the 5/100-year storm events will be directed to Design Point 31c via a 30" storm sewer stub at Sanderling Street. This design point is located at a high point and does not receive any interim existing flows from the undeveloped land east of Walley Drive.

Design Point 31b

Design Point 31b is located east of Walleye Drive/Grayling Drive and accepts flows from future development from Basin C8.4. A storm sewer will be stubbed out from Walleye Drive to collect this future flow and will convey it west in storm sewer to Design Point 32. The total future flow is 13.2cfs/29.4cfs in the 5/100-year storm events. These flows will be directed west to Design Point 32 via a 24" storm sewer stub from Walleye Drive/Grayling Drive. This design point is only for future flows into the storm sewer system which will be capped until development occurs to the east.

Design Point 31

Design Point 31 is located at the east side of Walleye Drive and Grayling Drive at a low point. Flow from existing Basin C3.1-ex (15.0cfs in 100-yr) will flow overland to curb/gutter to this design point before future development occurs in Basin C8.1 and C8.2. This inlet is designed for ultimate conditions which are higher flow rates than existing flows. Existing runoff is 15cfs in the 100-year storm event which is not likely to cause excessive erosion/sediment to be deposited in the street and the runoff is not a concentrated flow.

(5-year storm)

Tributary Basins: C8.2 — **Inlet/MH Number:** Inlet DP31
Upstream flowby: 10cfs from DP30 & DP31a — **Total Street Flow:** 14.5cfs

Flow Intercepted: 14.5cfs — **Flow Bypassed:**
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 10.6cfs, okay

(100-year storm)

Tributary Basins: C8.2 — **Inlet/MH Number:** Inlet DP31
Upstream flowby: 20cfs from DP30 & DP31a — **Total Street Flow:** 30.0cfs

Flow Intercepted: 30.0cfs — **Flow Bypassed:**
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 32.1cfs (half street) is okay

Design Point 31c
Design Point 31c is the storm sewer pipe flow (36" RCP) from Design Pt 31a (storm sewer) and Design Point 31. The total pipe flow is 23.4cfs/50.9cfs in the 5/100-year storm events in the storm sewer.

Design Point 32
Design Point 32 is the storm sewer pipe flow (42" RCP) from Design Pt 30 (storm sewer), Design Point 31b (storm sewer) and Design Point 31c. The total pipe flow is 45.1cfs/105.4cfs in the 5/100-year storm events in the storm sewer from the Xcel spreadsheets.

Design Point 33
Design Point 33 is located at the NE corner of Grayling Drive/Scrub Jay Trail at a 36" storm sewer stub. Future flows and drainage basins are not known at this time for this storm sewer stub so this storm sewer was oversized to accommodate possible future flows. We estimate the capacity of the 36" storm sewer at 1% slope to be 70cfs which can handle nearly all the flows from future developed runoff from Basin C8.5, C8.6, and Basin C8.7 In the future any flows above 70cfs can be routed to Inlet DP34 which is directly downstream from this design point. The total future flow at this design point can range from 7.3cfs/15.3cfs in the 5/100-year storm events up to 70cfs in the 100-year storm events. Future development in the tributary basins will be required to finalize design and construct inlets/manholes connected to the 36" storm sewer stub at this design point.

Design Point 34
Design Point 34 is located at the NW corner of Grayling Drive/Scrub Jay Trail and accepts runoff from future Basin C8.7. It is estimated that 30.9cfs/69.2cfs in the 5/100-year storm events will be collected at this Design Point. A 25' Type R inlet will be constructed at this time to complete the downstream storm sewer system. A future storm sewer system and inlets connected to the storm sewer will need to be designed to collect flow from Basin C8.7 and Design Point 33 in Scrub Jay Trail. The proposed 25' inlet will collect existing runoff from Basin C4.2-ex and the temp sediment basin of 85.1cfs in the 100-year storm sewer event at a depth of 1.01'.

Design Point 34a
Design Point 34a is located at the NW corner of Grayling Drive/Scrub Jay Trail and is the storm sewer flow (42" RCP) from future developed flow from Basins C8.5, C8.6, and C8.7 It is estimated that 38.2cfs/84.5cfs in the 5/100-year storm events is flowing in this storm sewer.

Design Point 34b
Design Point 34b is the storm sewer pipe flow (48" RCP) from Design Pt's 34a and Design Point 32. The total pipe flow is 83.3cfs/189.9cfs in the 5/100-year storm events in the storm sewer.

Design Point 35
Design Point 35 is the total developed future flow into Pond C4 from the C8 basins and Basin C10.10. The total inflow was calculated by the full spectrum Xcel worksheets. (see appendix for hydrograph spreadsheet). The total inflow to Pond C4 is 131.6cfs/277cfs in the 5/100-year storm events (see xcel spreadsheet).

Design Point 35a
Design Point 35a is the total developed outflow from Pond C4 calculated using the Full Spectrum EDB Xcel design spreadsheet. The total outflow is 16.5cfs/43.7cfs in the 5/100-year storm events in the 24" storm sewer pipe. The outflow rates are similar to the flows in the Lorson Ranch East MDDP (12.4cfs/40.5cfs) for this pond. In the interim state where there is no upstream development in the C8

basins and no full spectrum outlet structure, runoff comes from existing Basin C4.2-ex/C4.1-ex into the detention pond. Runoff will enter Pond C4 and will be detained/released by a 24” storm sewer pipe located at the west end of the pond. Pond C4 in the interim state was modeled in hydraflow to make sure the outflow rates do not exceed the future pond discharge downstream. The hydraflow model calculated the interim pond outflow (24” pipe outlet) to be 10.3cfs/21cfs in the 5/100-year storm events which is less than the designed future flows.

Design Point 36a

Design Point 36a is located at the east side of Big Bird Drive at a low point.

(5-year storm)

Tributary Basins: C10.4 **Inlet/MH Number:** Inlet DP36a

Upstream flowby: 0 cfs **Total Street Flow:** 5.2cfs

Flow Intercepted: 5.2cfs **Flow Bypassed:**

Inlet Size: 5’ type R, sump

Street Capacity: Street slope = 0.82%, capacity = 8.0cfs, okay

(100-year storm)

Tributary Basins: C10.4 **Inlet/MH Number:** Inlet DP36a

Upstream flowby: 0 cfs **Total Street Flow:** 11.6cfs

Flow Intercepted: 9.3cfs **Flow Bypassed:** 2.3cfs to DP36

Inlet Size: 5’ type R, sump

Street Capacity: Street slope = 0.82%, capacity = 33.4cfs (half street) is okay

Design Point 36

Design Point 36 is located at the west side of Big Bird Drive at a low point.

(5-year storm)

Tributary Basins: C10.1-C10.3 **Inlet/MH Number:** Inlet DP36

Upstream flowby: 0 cfs **Total Street Flow:** 7.2cfs

Flow Intercepted: 7.2cfs **Flow Bypassed:**

Inlet Size: 15’ type R, sump

Street Capacity: Street slope = 0.82%, capacity = 8.0cfs, okay

(100-year storm)

Tributary Basins: C10.4 **Inlet/MH Number:** Inlet DP36

Upstream flowby: 2.3cfs from Des.Pt.36a **Total Street Flow:** 18.2cfs

Flow Intercepted: 18.2cfs **Flow Bypassed:** 0

Inlet Size: 15’ type R, sump

Street Capacity: Street slope = 0.82%, capacity = 33.4cfs (half street) is okay

Design Point 37

Design Point 37 is the storm sewer pipe flow from Design Pt 36a and Design Point 36. The total pipe flow is 12.4cfs/27.5cfs in the 5/100-year storm events in the storm sewer.

Design Point 37a

Design Point 37a is the total developed flow into Pond C3 from the C10 basins and from Pond C4 outflow. The total inflow was calculated by the full spectrum Xcel worksheets by adding the CUHP hydrograph for the C10 basins to the Pond C4 outflow hydrograph (see appendix for hydrograph spreadsheet). The total inflow to Pond C2.2 is 41.2cfs/111.6cfs in the 5/100-year storm events (see xcel spreadsheet).

Design Point 37b

Design Point 37b is the total developed outflow from Pond C3 calculated using the Full Spectrum EDB Xcel design spreadsheet. The total outflow is 4.9cfs/32.1cfs in the 5/100-year storm events in the existing 24" storm sewer pipe. The outflow rates are higher than the flows in the Lorson Ranch East MDDP (5.0cfs/18.0cfs) for this pond but the overall downstream flow is reduced in Pond C2.2 located directly downstream.

Design Point 38a (ultimate development conditions)

Design Point 38a is located west of Lamprey Drive and Grayling Drive and accepts flows from future development from Basin C10.10. When this basin in developed, a 24" storm sewer will be constructed from Pond C4 to collect flows at this design point and convey them east to Pond C4 for detention and water quality treatment. The total future flow accepted is 11.5cfs/25.3cfs in the 5/100-year storm events in the storm sewer.

Design Point 38a (interim conditions)

Design Point 38a is located within existing Basin C5.2-ex. In interim conditions, existing runoff from undeveloped areas in Basin C5.2-ex will flow overland to the southwest to Grayling Drive. Runoff will then travel southeast in curb/gutter to a Type R inlet at Design Point 40. Also see Design Point 39 for a analysis of the street capacity of the east side of Grayling Drive from Basin C5.2-ex.

Design Point 38

Design Point 38 is located at the NE corner of Grayling Drive and Lamprey Drive and accepts flows from future development from Basin C10.7 and C5.1-ex. The runoff will be conveyed to Design Point 39 via curb/gutter. The total future flow accepted is 6.8cfs/21.9cfs in the 5/100-year storm events.

Design Point 39 (ultimate development conditions)

Design Point 39 has been added to analyze the street flow on the east side of Grayling Drive north of Design Point 40. The total future flow accepted is from Basin C5.1-ex, C10.7, and C10.8 flowing in the curb/gutter on the north side of Grayling Drive. The total curb/gutter flow is 8.8cfs/25.7cfs in the 5/100-year storm events. The street capacity of Grayling Drive is 10.6cfs/32.1cfs in the 5/100-year storm events at a street slope of 0.6%.

Design Point 39 (interim conditions)

Design Point 39 has been added to analyze the street flow on the east side of Grayling Drive north of Design Point 40. In the interim conditions with no development east of Grayling Drive, runoff from basins C5.1-ex and C5.2-ex will flow overland to the east curb line of Grayling Drive then will flow southeast to Inlet DP-40. The total interim (existing) flow is 4.8cfs/31.4cfs in the 5/100-year storm events. The street capacity of Grayling Drive is 10.6cfs/32.1cfs in the 5/100-year storm events at a street slope of 0.6%. In comparison to the ultimate conditions at this design point the 5-year flow is less than ultimate and the 100-year is slightly above ultimate conditions at the downstream inlet DP-40. If the inlet at DP-40 is clogged or is under capacity for the 100-year storm, runoff will flow directly overland to Pond C3. The interim conditions can be handled by the storm sewer system in Grayling Drive.

Design Point 40
Design Point 40 is located on the north side of Grayling Drive at a low point.

(5-year storm)
Tributary Basins: C10.6+C10.8+C10.9+Des.Pt.38 **Inlet/MH Number:** Inlet DP40
Upstream flowby: 0 cfs **Total Street Flow:** 14.7cfs

Flow Intercepted: 14.7cfs **Flow Bypassed:**
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 10.6cfs, street capacity okay since Basin C10.9 (5.9cfs) flows directly to Inlet DP40

(100-year storm)
Tributary Basins: C10.6+C10.8+C10.9+Des.Pt.38 **Inlet/MH Number:** Inlet DP40
Upstream flowby: 0cfs **Total Street Flow:** 38.5cfs

Flow Intercepted: 35.6cfs **Flow Bypassed:** 2.9cfs to Des.Pt 40a
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 32.1cfs (half street) street capacity okay since Basin C10.9 (13.9cfs) flows directly to Inlet DP40

In existing conditions Inlet DP40 accepts flow from Design Point 5x discussed in the existing hydrological conditions section of this report. (4.2cfs/27.2cfs in the 5/100-year storm events) which is less than the total developed flow.

Design Point 40a
Design Point 40a is located on the south side of Grayling Drive at a low point.

(5-year storm)
Tributary Basins: C10.5 **Inlet/MH Number:** Inlet DP40a
Upstream flowby: 0 cfs **Total Street Flow:** 1.8cfs

Flow Intercepted: 1.8cfs **Flow Bypassed:**
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 10.6cfs, street capacity okay

(100-year storm)
Tributary Basins: C10.5 **Inlet/MH Number:** Inlet DP40a
Upstream flowby: 2.9cfs from Des.Pt. 40 **Total Street Flow:** 6.9cfs

Flow Intercepted: 6.9cfs **Flow Bypassed:** 0
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 0.6%, capacity = 32.1cfs (half street) street capacity okay

Design Point 40b
Design Point 40b is the storm sewer pipe flow from Design Pt. 40 and Design Point 40a . The total pipe flow is 16.5cfs/42.5cfs in the 5/100-year storm events in the storm sewer.

Design Point 40c
Design Point 40c is the storm sewer pipe flow from Design Pt. 35a (Pond C4 outflow) and Design Point 40b. The total pipe flow is 33.0cfs/86.2cfs in the 5/100-year storm events in the storm sewer.

Design Point 41
Design Point 41 is located on the south side of Yellowthroat Terrace at a low point.

(5-year storm)
Tributary Basins: C12.1
Inlet/MH Number: Inlet DP41
Upstream flowby: 0 cfs
Total Street Flow: 2.4cfs

Flow Intercepted: 2.4cfs
Flow Bypassed:
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 1.0%, capacity = 9.0cfs, street capacity okay

(100-year storm)
Tributary Basins: C12.1
Inlet/MH Number: Inlet DP41
Upstream flowby:
Total Street Flow: 5.4cfs

Flow Intercepted: 5.4cfs
Flow Bypassed: 0
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 1.0%, capacity = 37.3cfs (half street) street capacity okay

Design Point 42
Design Point 42 is located on the south side of Bobolink Trail west of Murrelet Drive.

(5-year storm)
Tributary Basins: C12.2+C12.3
Inlet/MH Number: Inlet DP42
Upstream flowby: 0 cfs
Total Street Flow: 6.4cfs

Flow Intercepted: 6.4cfs
Flow Bypassed:
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 0.65%, capacity = 7.0cfs, street capacity okay

(100-year storm)
Tributary Basins: C12.2+C12.3
Inlet/MH Number: Inlet DP42
Upstream flowby:
Total Street Flow: 14.1cfs

Flow Intercepted: 11.5cfs
Flow Bypassed: 2.6cfs to Des.Pt.43
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 0.65%, capacity = 30.0cfs (half street) street capacity okay

Design Point 42a
Design Point 42a is the storm sewer pipe flow from Design Pt. 42 and Design Point 41. The total pipe flow is 8.8cfs/16.9cfs in the 5/100-year storm events in the storm sewer.

Design Point 43
Design Point 43 is located at the SW corner of Lamprey Drive and Murrelet Drive.

(5-year storm)
Tributary Basins: C12.4+C12.5 **Inlet/MH Number:** Inlet DP43
Upstream flowby: 0 cfs **Total Street Flow:** 7.3cfs

Flow Intercepted: **Flow Bypassed:** 7.3cfs to Des.Pt. 45a
Inlet Size:

Street Capacity: Street slope = 0.8%, capacity = 8.0cfs, street capacity okay

(100-year storm)
Tributary Basins: C12.4+C12.5 **Inlet/MH Number:** Inlet DP43
Upstream flowby: 2.6cfs from Des.Pt. 42 **Total Street Flow:** 18.9cfs

Flow Intercepted: **Flow Bypassed:** 18.9cfs to Des.Pt.45a
Inlet Size:

Street Capacity: Street slope = 0.8%, capacity = 33.4cfs (half street) street capacity okay

Design Point 44
Design Point 44 is located at the SE corner of Lamprey Drive and Murrelet Drive at a low point.

(5-year storm)
Tributary Basins: C12.6-C12.8 **Inlet/MH Number:** Inlet DP44
Upstream flowby: 0 cfs **Total Street Flow:** 8.2cfs

Flow Intercepted: 8.2cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.0%, capacity = 9.0cfs, street capacity okay

(100-year storm)
Tributary Basins: C12.6-C12.8 **Inlet/MH Number:** Inlet DP44
Upstream flowby: **Total Street Flow:** 17.7cfs

Flow Intercepted: 8.3cfs **Flow Bypassed:** 9.4cfs to Des.Pt. 45a
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.0%, capacity = 37.3cfs (half street) street capacity okay

Design Point 45
Design Point 45 is the storm sewer pipe flow from Design Pt. 42a and Design Point 44. The total pipe flow is 17.0cfs/25.2cfs in the 5/100-year storm events in the storm sewer.

Design Point 45a
Design Point 45a is located on the south side of Lamprey Drive west of Murrelet Drive.

(5-year storm)
Tributary Basins: C12.9 **Inlet/MH Number:** Inlet DP45a
Upstream flowby: 7.3cfs from Des.Pt.43 **Total Street Flow:** 8.0cfs

Flow Intercepted: 7.9cfs **Flow Bypassed:** 0.1cfs
Inlet Size: existing 15' type R, on-grade

Street Capacity: Street slope = 1.9%, capacity = 18.4cfs, street capacity okay

(100-year storm)
Tributary Basins: C12.9 **Inlet/MH Number:** Inlet DP45a
Upstream flowby: 23.3cfs from DP43+44 **Total Street Flow:** 30.6 cfs

Flow Intercepted: 17.5cfs **Flow Bypassed:** 13.1cfs in Lamprey Drive
Inlet Size: existing 15' type R, on-grade

Street Capacity: Street slope = 1.9%, capacity = 50.4cfs (half street) street capacity okay

Design Point 46 (street flow)
Design Point 46 was added to analyze the street flow in the south side of Lamprey Drive. The allowable runoff bypassing Inlet DP45a is 0cfs/33.0cfs in the 5/100-year storm events per the final drainage report for CDR183. The total flow bypassing Inlet DP45a is 0.1cfs/13.1cfs in the 5/100-year storm events in the south curb/gutter of Lamprey Drive. Both storm events meets the CDR183 drainage report criteria.

Design Point 46 (storm sewer flow)
Design Point 46 is the storm sewer pipe flow from Design Pt. 45a and Design Point 45 . The total pipe flow is 24.9cfs/40.0cfs in the 5/100-year storm events in the storm sewer. The allowable flow in the storm sewer is 33.0cfs/40.5cfs in the 5/100-year storm events in the storm sewer per the final drainage report for CDR183. The storm sewer system meets the CDR183 drainage report criteria.

Design Point 47a
Design Point 47a is located south of Lorson Boulevard east of Lamprey Drive and accepts flows from future development from Basin D1.1. An 18" RCP storm sewer will be stubbed out to collect future flow at this design point. The total future flow accepted is 4.6cfs/10.1cfs in the 5/100-year storm events in the storm sewer.

Design Point 47b
Design Point 47b is located south of Lorson Boulevard east of Lamprey Drive and accepts flows from future development from D1.2. An 18" RCP storm sewer will be stubbed out to collect future flow at this design point. The total future flow accepted is 5.9cfs/13.0cfs in the 5/100-year storm events in the storm sewer.

Design Point 47c

Design Point 47c is located on the south side of Lorson Boulevard east of Lamprey Drive.

(5-year storm)
Tributary Basins: D1.3 **Inlet/MH Number:** Inlet DP47c
Upstream flowby: **Total Street Flow:** 3.2cfs

Flow Intercepted: 3.2cfs **Flow Bypassed:**
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 4.4%, capacity = 16.2cfs, okay

(100-year storm)
Tributary Basins: D1.3 **Inlet/MH Number:** Inlet DP47c
Upstream flowby: **Total Street Flow:** 6.0cfs

Flow Intercepted: 5.44cfs **Flow Bypassed:** 0.56cfs to Inlet DP47e
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 4.4%, capacity = 39.7cfs (half street) is okay

Design Point 47d

Design Point 47d is located on the north side of Lorson Boulevard east of Lamprey Drive.

(5-year storm)
Tributary Basins: D1.4 **Inlet/MH Number:** Inlet DP47d
Upstream flowby: **Total Street Flow:** 3.5cfs

Flow Intercepted: 2.48cfs **Flow Bypassed:** 1.02cfs to Des. Pt 47g
Inlet Size: 5' type R, on-grade

Street Capacity: Street slope = 4.4%, capacity = 16.2cfs, okay

(100-year storm)
Tributary Basins: D1.4 **Inlet/MH Number:** Inlet DP47d
Upstream flowby: **Total Street Flow:** 7.6cfs

Flow Intercepted: 3.57cfs **Flow Bypassed:** 4.03cfs to Des. Pt 47g
Inlet Size: 5' type R, on-grade

Street Capacity: Street slope = 4.4%, capacity = 39.7cfs (half street) is okay

Design Point 47

Design Point 47 is the storm sewer pipe flow in Lorson Boulevard. A 24" RCP storm sewer will be constructed west to an existing manhole constructed as part of Lorson Ranch East Filing No. 4. The total pipe flow is 16.18cfs/32.11cfs in the 5/100-year storm events in the storm sewer. The allowable flow in this storm sewer per the Lorson Ranch East Filing No. 1 FDR (Des. Pt 59b) is 23cfs/60cfs in the 5/100-year storm events.

Design Point 47e
Design Point 47e is located on the south side of Lorson Boulevard east of Lamprey Drive.

(5-year storm
Tributary Basins: D1.5 **Inlet/MH Number:** Inlet DP47e
Upstream flowby: **Total Street Flow:** 2.60cfs

Flow Intercepted: 2.60cfs **Flow Bypassed:**
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 2.7%, capacity = 18.5cfs, okay

(100-year storm)
Tributary Basins: D1.5 **Inlet/MH Number:** Inlet DP47e
Upstream flowby: 0.56cfs from Inlet DP-47c **Total Street Flow:** 9.56cfs

Flow Intercepted: 6.9cfs **Flow Bypassed:** 2.1cfs downstream
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 2.7%, capacity = 45.1cfs (half street) is okay

Design Point 47f
Design Point 47f is the total pipe flow in the existing 36" storm sewer in Lorson Boulevard. Flow in the pipe is from Design Point 47, Design Point 47e, and from Lorson Ranch East Filing No. 4 (Des. Pt. 59a). The total pipe flow is 20.88cfs/43.96cfs in the 5/100-year storm events in the storm sewer. The allowable flow in this storm sewer per the Lorson Ranch East Filing No. 4 FDR (Des. Pt 59c) is 25.7cfs/75.4cfs in the 5/100-year storm events.

Design Point 47g
Design Point 47g is located at an existing 15' Type R inlet at the NE corner of Lamprey Drive/Lorson Boulevard. This design point was added to analyze developed runoff at the existing inlet coming from the east. The runoff at Design Point 47g (from the east) is from Basin D1.6 and runby from Design Point 47d. The total street flow from the east is 1.92cfs/9.83cfs in the 5/100-year storm events in the storm sewer. The allowable street flow (from the east) per the Lorson Ranch East Filing No. 4 FDR (Basin D2.3) is 2.7cfs/9.7cfs in the 5/100-year storm events. The 100-year is slightly over the allowable but will not negatively impact downstream facilities. The existing inlet does not have to be modified.

6.0 DETENTION AND WATER QUALITY PONDS

Detention and Storm Water Quality for The Hills at Lorson Ranch is required per El Paso County criteria. We have implemented the Full Spectrum approach for detention for the Denver Urban Drainage Districts specifications. There are six permanent full spectrum ponds proposed for this development which will incorporate storm water quality features and comply with the Lorson Ranch East MDDP. The ponds have been sized and include access roads, outlet pipes, overflow structures, and low flow channels. This drainage report provides design information on the outlet structure, trickle channel, and the forebays.

Full Spectrum Pond Construction Requirements

There are two ponds that have been previously graded (Pond C1 and Pond C3) and four ponds that will be graded with this development (Pond C2.1, C2.2, C2.3, C4). Each pond will be discussed in this section including what type of structure is proposed and when the structures will be built. Structures built under CDR 20-007 will occur in 2020. Structures built under the first plat in The Hills will occur in 2020-2021. The remaining structures will be built in future plat submittals as development occurs east/north of this site.

Design calculations for all full spectrum ponds are included in this report. Grading of the ponds is shown on the Early Grading plans for The Hills at Lorson Ranch at this time in the Preliminary Plan submittal. The final design will include a 15' wide gravel access road at a maximum 10% slope to the pond bottom, forebay, and outlet structure. The final design of the full spectrum ponds will consist of an outlet structure, storm sewer outfall, concrete low flow channels, sediment forebays, and overflow weirs. Soil borings, embankment, slope, and compaction requirements for detention ponds can be found in the geotechnical report for the The Hills at Lorson Ranch prepared by RMG.

UDFCD
(typical revision throughout)

Detention Pond C1

This is an on-site permanent full spectrum detention pond that includes water quality and discharges downstream to a storm sewer system in Fontaine Boulevard. Pond C1 was graded in 2019 and will be made larger with this grading plan. The outlet Structure, low flow channel, forebays, and overflow wall will be built as part of the first final plat submittal. Pond C1 is designed in the UDCF Full Spectrum spreadsheets for Water Quality and EURV volumes. The 5-year and 100-year flow rates meet the Lorson East MDDP and have been modeled in the full spectrum worksheets. The outlet structure is a standard full spectrum extended detention basin structure and will include an emergency overflow spillway. The full spectrum print outs are in the appendix of this report. See Design Point 11a for discussion on outflow comparisons between the Lorson Ranch East MDDP and this final design. See map in appendix for watershed areas.

Show spillway
on plans

- Watershed Area: 76 acres
- Watershed Imperviousness: 55%
- Hydrologic Soils Group B
- Zone 1 WQCV: 1.397ac-ft, WSEL: 5747.04
- Zone 2 EURV: 4.505ac-ft, WSEL: 5749.21, Top outlet structure set at 5749.50, 3'x6' outlet structure
- (5-yr): 5.006ac-ft, WSEL: 5749.54, 7.1cfs
- Zone 3 (100-yr): 10.736ac-ft, WSEL: 5752.80, 18.1cfs
- Pipe Outlet: 18" RCP at 0.5%

- Overflow Spillway: 28’ wide bottom, elevation=5753.40, 4:1 side slopes, flow depth=1.44’ 1.16’ freeboard
- Micropool Elevation: 5743.40

SWMP states that ponds C2.1 and C4 are existing. Reconcile the differences between the SWMP and FDR. Would also help to label these two ponds as "existing" in the GEC Plans and show existing in gray and proposed components in black.

Detention Pond C2.1

This is an on-site permanent full spectrum detention pond that includes water quality and discharges downstream to Pond C2.3. Pond C2.1 will be graded with this grading plan. The outlet Structure and overflow wall will be built as part of the first final plat. The pond forebay and low flow channel will be built as part of the CDR 20-007 project. Pond C2.1 is designed in the UDCF Full Spectrum spreadsheets for Water Quality and EURV volumes. The 5-year and 100-year flow rates meet the Lorson East MDDP and have been modeled in the modeled in the full spectrum worksheets. The outlet structure is a standard full spectrum extended detention basin structure and will include an emergency overflow spillway. The full spectrum print outs are in the appendix of this report. See Design Point 15a for discussion on outflow comparisons between the Lorson Ranch East MDDP and this final design. See map in appendix for watershed areas.

- Watershed Area: 74.5 acres (Future Area)
- Watershed Imperviousness: 55%
- Hydrologic Soils Group B
- Zone 1 WQCV: 1.377ac-ft, WSEL: 5764.42
- Zone 2 EURV: 4.415ac-ft, WSEL: 5767.20, Top outlet structure set at 5767.20, 8’x6’ outlet structure
- (5-yr): 4.694ac-ft, WSEL: 5767.44, 12.8cfs
- Zone 3 (100-yr): 7.829ac-ft, WSEL: 5769.80, 65.0cfs
- Pipe Outlet: 30” RCP at 0.5%
- Overflow Spillway: 25’ wide bottom, elevation=5770.30, 4:1 side slopes, flow depth=1.69’ 1.01’ freeboard
- Micropool Elevation: 5761.00

Detention Pond C2.2

This is an on-site permanent full spectrum detention pond that includes water quality and discharges downstream to an existing storm sewer in Fontaine Boulevard. Inflow to this pond is from direct tributary development and outflow from Pond C3. The inflow hydrograph has been modeled in the full spectrum spreadsheets by adding the direct tributary area CUHP hydrograph to the upstream pond outflow hydrograph of Pond C3. This combined hydrograph can be found in the appendix of this report. Pond C2.2 will be graded with this grading plan. The outlet structure, overflow wall, pond forebay and low flow channel will be built as part of the CDR 20-007 project. Pond C2.2 is designed in the UDCF Full Spectrum spreadsheets for Water Quality and EURV volumes. The 5-year and 100-year flow rates meet the Lorson East MDDP and have been modeled in the modeled in the full spectrum worksheets. The outlet structure is a standard full spectrum extended detention basin structure and will include an emergency overflow spillway. The full spectrum print outs are in the appendix of this report. See Design Point 29a for discussion on outflow comparisons between the Lorson Ranch East MDDP and this final design. See map in appendix for watershed areas. Pond C2.2 will require an emergency overflow conveyance structure located downstream of the full spectrum outlet in accordance with the Lorson Ranch East MDDP. See Design Point 29a for discussion of the conveyance structure.

- Watershed Area: 45.0 acres
- Watershed Imperviousness: 55%
- Hydrologic Soils Group B (95%), Group C/D (5%)
- Zone 1 WQCV: 0.829ac-ft, WSEL: 5747.25
- Zone 2 EURV: 2.658ac-ft, WSEL: 5749.17, Top outlet structure set at 5751.00, 8’x6’ outlet structure

- (5-yr): 4.475ac-ft, WSEL: 5760.88, 2.7cfs
- Zone 3 (100-yr): 6.67ac-ft, WSEL: 5752.75, 42.9cfs
- Pipe Outlet: 30" RCP
- Overflow Spillway: 20' wide bottom, elevation=5754.00, 4:1 side slopes, flow depth=1.51' 1.49' freeboard
- Micropool Elevation: 5744.00

Detention Pond C2.3

This is an on-site permanent full spectrum detention pond that includes water quality and discharges downstream to an existing storm sewer in Fontaine Boulevard. Inflow to this pond is from direct tributary development and outflow from Pond C2.1. The inflow hydrograph has been modeled in the full spectrum spreadsheets by adding the direct tributary area CUHP hydrograph to the upstream pond outflow hydrograph from Pond C2.1. This combined hydrograph can be found in the appendix of this report. Pond C2.2 will be graded with this grading plan. The outlet structure, overflow wall, pond forebay and low flow channel will be built as part of the CDR 20-007project. Pond C2.3 is designed in the UDCF Full Spectrum spreadsheets for Water Quality and EURV volumes. The 5-year and 100-year flow rates meet the Lorson East MDDP and have been modeled in the modeled in the full spectrum worksheets. The outlet structure is a standard full spectrum extended detention basin structure and will include an emergency overflow spillway. The full spectrum print outs are in the appendix of this report. See Design Point 25 for discussion on outflow comparisons between the Lorson Ranch East MDDP and this final design. See map in appendix for watershed areas. Pond C2.3 will require an emergency overflow conveyance structure located downstream of the full spectrum outlet in accordance with the Lorson Ranch East MDDP. See Design Point 25 for discussion of the conveyance structure.

- Watershed Area: 16.0 acres
- Watershed Imperviousness: 55%
- Hydrologic Soils Group B (40%), Group C/D (60%)
- Zone 1 WQCV: 0.296ac-ft, WSEL: 5746.57
- Zone 2 EURV: 0.887ac-ft, WSEL: 5747.61, Top outlet structure set at 5751.67, 8'x6' outlet structure
- (5-yr): 1.993ac-ft, WSEL: 5749.27, 5.5cfs
- Zone 3 (100-yr): 5.014ac-ft, WSEL: 5752.96, 64.9cfs
- Pipe Outlet: 30" RCP
- Overflow Spillway: 20' wide bottom, elevation=5753.50, 4:1 side slopes, flow depth=1.17' 1.33' freeboard
- Micropool Elevation: 5744.17

Detention Pond C3

This is an on-site permanent full spectrum detention pond that includes water quality and discharges downstream to Pond C2.2. Inflow to this pond is from direct tributary development and outflow from Pond C4. The inflow hydrograph has been modeled in the full spectrum spreadsheets by adding the direct tributary area CUHP hydrograph to the upstream pond outflow hydrograph of Pond C4. This combined hydrograph can be found in the appendix of this report. Pond C3 was graded in 2018 as part of the Lorson Ranch East Filing No. 2 final plat. The outlet Structure, low flow channel, forebays, and overflow wall will be built as part of the first final plat submittal. Pond C3 is designed in the UDCF Full Spectrum spreadsheets for Water Quality and EURV volumes. The 5-year and 100-year flow rates meet the Lorson East MDDP and have been modeled in the modeled in the full spectrum worksheets. The outlet structure is a standard full spectrum extended detention basin structure and will include an emergency overflow spillway. The full spectrum print outs are in the appendix of this report. See Design Point 37b for discussion on outflow comparisons between the Lorson Ranch East MDDP and this final design. See map in appendix for watershed areas.

- Watershed Area: 26.0 acres
- Watershed Imperviousness: 52%
- Hydrologic Soils Group B (20%), Group C/D (80%)

- Zone 1 WQCV: 0.463ac-ft, WSEL: 5758.01
- Zone 2 EURV: 1.322ac-ft, WSEL: 5759.08, Top outlet structure set at 5761.90, 6'x6' outlet structure
- (5-yr): 3.348ac-ft, WSEL: 5760.92, 4.9cfs
- Zone 3 (100-yr): 7.459ac-ft, WSEL: 5764.02, 32.1cfs
- Pipe Outlet: 24" RCP at 0.5%
- Overflow Spillway: 20' wide bottom, elevation=5764.50, 4:1 side slopes, flow depth=1.32' 1.68' freeboard
- Micropool Elevation: 5755.17

<u>Detention Pond C4</u>
This is a permanent full spectrum detention pond that includes water quality and discharges downstream to Pond C3. Pond C4 will be graded with this grading plan. The outlet Structure and overflow wall will be built in the future. The pond forebay and low flow channel will be built as part of the CDR 20-007 project. Pond C4 is designed in the UDCF Full Spectrum spreadsheets for Water Quality and EURV volumes. The 5-year and 100-year flow rates meet the Lorson East MDDP and have been modeled in the modeled in the full spectrum worksheets. The outlet structure is a standard full spectrum extended detention basin structure and will include an emergency overflow spillway. The full spectrum print outs are in the appendix of this report. See Design Point 35a for discussion on outflow comparisons between the Lorson Ranch East MDDP and this final design. See map in appendix for watershed areas.

- Watershed Area: 81.00 acres (Future Area)
- Watershed Imperviousness: 55%
- Hydrologic Soils Group B (40%), Group C/D (60%)
- Zone 1 WQCV: 1.488ac-ft, WSEL: 5767.97
- Zone 2 EURV: 4.477ac-ft, WSEL: 5770.41, Top outlet structure set at 5770.50, 6'x6' outlet structure
- (5-yr): 3.934ac-ft, WSEL: 5770.84, 16.5cfs
- Zone 3 (100-yr): 10.152ac-ft, WSEL: 5774.34, 43.7cfs
- Pipe Outlet: 24" RCP at 0.5%
- Overflow Spillway: 30' wide bottom, elevation=5775.00, 4:1 side slopes, flow depth=1.87' 1.13' freeboard
- Micropool Elevation: 5765.00

<u>C12 basins</u>
Developed runoff from the "C12" basins will be treated for water quality/detention by existing Pond C5 located downstream next to the East Tributary of Jimmy Camp Creek per the Lorson Ranch East Filing No. 1 drainage report. The flows are in conformance with the design of Pond C5. See Lorson Ranch East Filing No. 1 FDR.

<u>D1 basins</u>
Developed runoff from the "D1" basins will be treated for water quality/detention by existing Pond D2 located downstream next to the East Tributary of Jimmy Camp Creek per the Lorson Ranch East Filing No. 1 drainage report.

<u>Water Quality Design</u>
Water quality will be provided by these six permanent extended detention basins for the entire PUD Area and for the CDR 20-007 area. Temporary sediment basins have been added along the east side of the PUD area to prevent sediment from entering streets and storm sewer system with the exception of two areas. Existing Basin C3.1-ex (8.36ac) will be allowed to flow overland to Walleye Drive. Existing Basin C5.1-ex/C5.2-ex will be allowed to flow overland to Grayling Drive. Both of these areas will be monitored to ensure sediment does not deposit into the streets/storm sewer. Rock check dams or other semi-permanent erosion control measure could be constructed should erosion occur.

7.0 DRAINAGE AND BRIDGE FEES

The Hills at Lorson Ranch is located within the Jimmy Camp Creek drainage basin which is currently a

fee basin in El Paso County. Current El Paso County regulations require drainage and bridge fees to be paid for platting of land as part of the plat recordation process.

Lorson Ranch Metro District will compile and submit to the county on a yearly basis the Drainage and bridge fees for the approved plats and shall show all credits they have received for the same yearly time frame.

The Hills at Lorson Ranch Filing No. 1 contains 123.169 acres. This project consists of 38.173 acres of open space (2% impervious) and 84.996 acres residential. The 2020 drainage fees are $19,084, bridge fees are $893 and Drainage Surety fees are $7,285 per impervious acre per Resolution 18-470. The drainage and bridge fees are calculated when the final plat is submitted. The fees are due at plat recordation. The following table details the drainage fees for the platted area. Lorson Ranch intends to use the Bridge Fee credits for the bridge fees and pay drainage/surety fees unless the Jimmy Camp Creek DBPS drainage fee structure is updated by El Paso County.

Use 2021 fees: $19,752, $924

Table 1: 2020 Drainage/Bridge Fees

Type of Land Use	Total Area (ac)	Imperviousness	Drainage Fee	Bridge Fee	Surety Fee
Residential Area	84.996	51%	$827,252	$38,709	$315,789
Open Space, Landscape Tracts,	38.173	2%	$14,569	$681	$5,561
		Total	$841,821	$39,390	$321,350

Table 7.1: Public Drainage Facility Costs (non-reimbursable)

Item	Quantity	Unit	Unit Cost	Item Total
Rip Rap	100	CY	$50/CY	$5,000
Inlets/Manholes	82	EA	$3000/EA	$246,000
18” Storm	1490	LF	$35	$52,150
24” Storm	2204	LF	$40	$88,160
30” Storm	625	LF	$45	$28,125
36” Storm	926	LF	$55	$50,930
42” Storm	3065	LF	$65	$199,225
48” Storm	442	LF	$85	$37,570
54” Storm	80	LF	$100	$8,000
			Subtotal	$715,160
			Eng/Cont (10%)	$71,516

	Total Est. Cost	$786,676

Table 7.2: Lorson Ranch Metro District Drainage Facility Costs (non-reimbursable)

Item	Quantity	Unit	Unit Cost	Item Total
Full Spectrum Ponds and Outlet	6	LS	$80,000	$480,000
			Subtotal	$480,000
			Eng/Cont (15%)	$72,000
			Total Est. Cost	$552,000

Revise the 4 steps to match those shown in: ECM Section I.7.2 BMP Selection

8.0 FOUR STEP PROCESS

The site has been developed to minimize wherever possible the rate of developed runoff that will leave the site and to provide water quality management for the runoff produced by the site as proposed on the development plan. The following four step process should be considered and incorporated into the storm water collection system and storage facilities where applicable.

Step 1: Employ Runoff Reduction Practices
The Hills at Lorson Ranch has employed several methods of reducing runoff.

- The street configuration was laid out to minimize the length of streets. Many streets are straight and perpendicular resulting in lots with less wasted space.
- There are large open space buffers under the 325' wide electric transmission easement
- Construct six Full Spectrum Detention Ponds. The full spectrum detention mimics existing storm discharges and includes water quality.

Step 2: Implement BMP's that Slowly Release the Water Quality Capture Volume
Treatment and slow release of the water quality capture volume (WQCV) is required. The Hills at Lorson Ranch will construct six full spectrum stormwater detention pond which includes Water Quality Volumes and WQ outlet structures.

Step 3: Stabilize Drainageways
East Tributary of Jimmy Camp Creek is a major drainageway located west of this site. In 2014 and in 2018 the East Tributary of JCC was reconstructed and stabilized per county criteria. The design included a natural sand bottom and armored sides.

Step 4: Implement Site Specific & Source Control BMP's
There are no potential sources of contaminants that could be introduced to the County's MS4. During construction source control will be provided with the proper installation of erosion control BMPs to limit erosion and transport of sediment. Area disturbed by construction will be seeded and mulched. Cut and fill slopes will be reseeded, and the slopes equal to or greater than three-to-one will be protected with erosion control fabric. Silt fences will be placed at the bottom of re-vegetated and rough graded slopes. Inlet protection will be used around proposed inlets. In addition, temporary sediment basins will be constructed so runoff will be treated prior to discharge. Construction BMPs in the form of vehicle tracking control, sediment basins, concrete washout area, rock socks, buffers, and silt fences will be utilized to protect receiving waters.

9.0 CONCLUSIONS

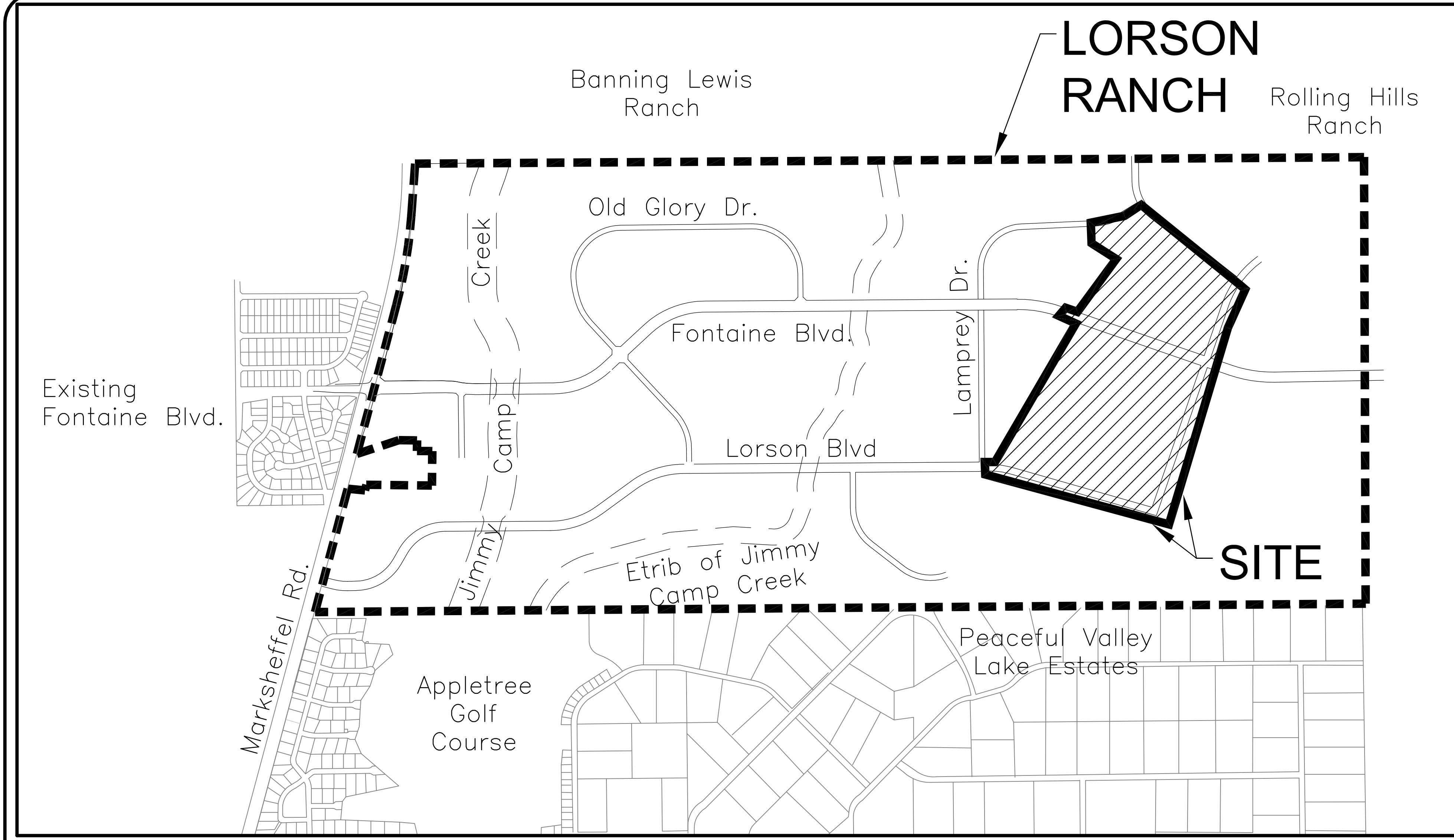
This drainage report has been prepared in accordance with the City of Colorado Springs/El Paso County Drainage Criteria Manual. The proposed development and drainage infrastructure will not cause adverse impacts to adjacent properties or properties located downstream. Several key aspects of the development discussed above are summarized as follows:

- Developed runoff will be conveyed via curb/gutter and storm sewer facilities
- The East Tributary of Jimmy Camp Creek has been reconstructed west of this study area
- Bridges over the East Tributary at Lorson Boulevard and Fontaine Boulevard and have been constructed providing access to this site.
- Detention and water quality for this site area will be provided in six permanent ponds

10.0 REFERENCES

1. City of Colorado Springs/El Paso County Drainage Criteria Manual DCM, dated November, 1991
2. Soil Survey of El Paso County Area, Colorado by USDA, SCS
3. Jimmy Camp Creek Drainage Basin Planning Study, Dated March 9, 2015, by Kiowa Engineering Corporation
4. City of Colorado Springs "Drainage Criteria Manual, Volume 2
5. El Paso County "Engineering Criteria Manual"
6. Lorson Ranch East MDDP, June 30, 2017 by Core Engineering.
7. El Paso County Resolution #15-042, El Paso County adoption of Chapter 6 and Section 3.2.1 of the City of Colorado Springs Drainage Criteria Manual dated May, 2014.
8. Lorson Ranch East MDDP prepared by Core Engineering Group, dated November 27, 2017
9. Final Drainage Report for Fontaine Boulevard prepared by Core Engineering Group, Reference CDR183, dated December 20, 2017
10. Final Drainage Report for Lorson Ranch East Filing No. 1 prepared by Core Engineering Group, Reference SF18-008, approved July 24, 2018
11. Final Drainage Report for Lorson Ranch East Filing No. 4 prepared by Core Engineering Group, Reference SF19-008, approved September 12, 2019
12. Preliminary/ Drainage Report for the Hills at Lorson Ranch prepared by Core Engineering Group, Reference PUD/SP 20-003, approved November 25, 2020
13.

APPENDIX A – VICINTIY MAP, SOILS MAP, FEMA MAP



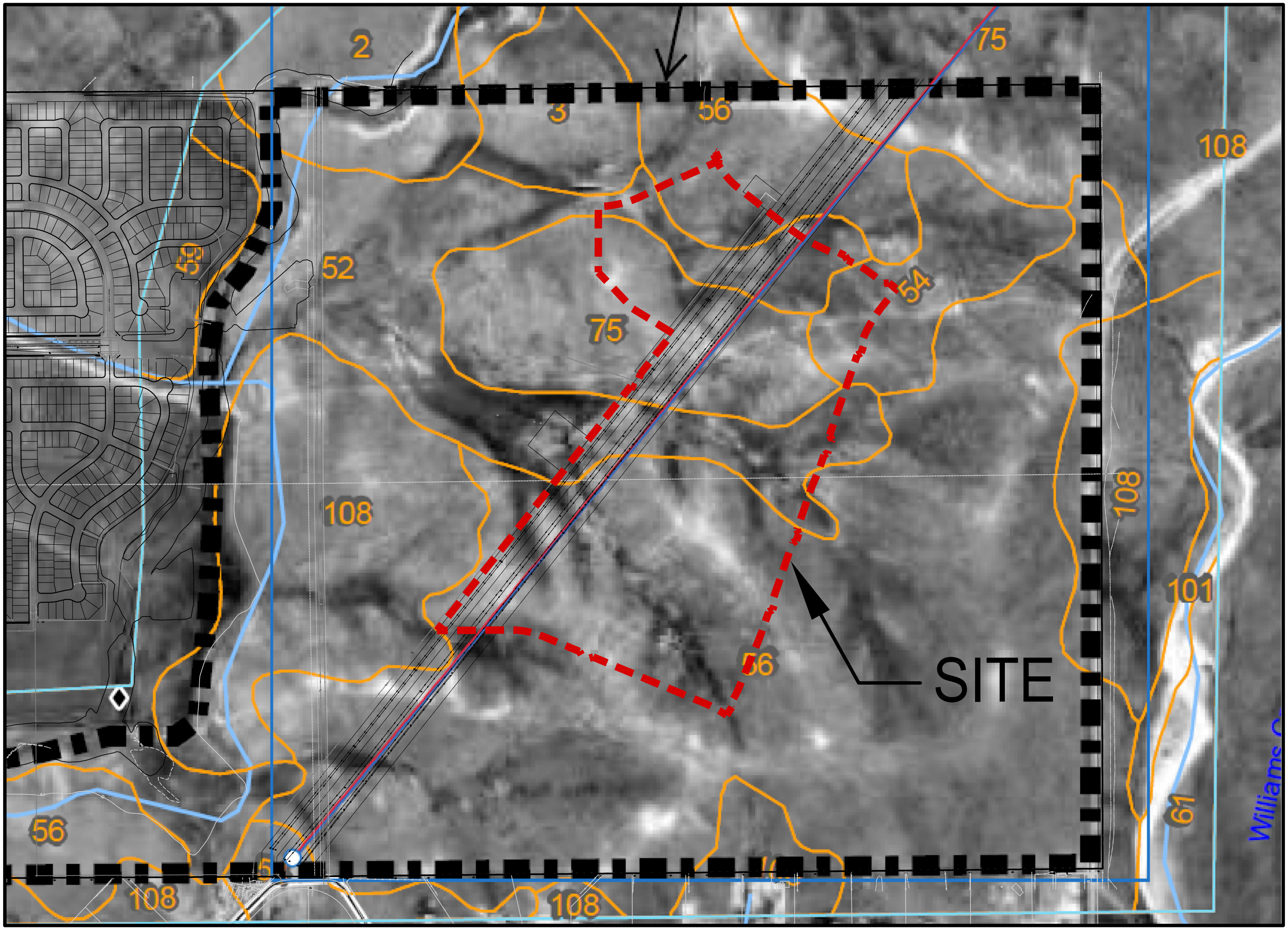
VICINITY MAP
NO SCALE

CORE
ENGINEERING GROUP
15004 1ST AVE. S.
BURNSVILLE, MN 55306
PH: 719.570.1100

CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

THE HILLS AT LORSON RANCH
VICINITY MAP

SCALE:	DATE:	FIGURE NO.
NTS	MAY 25, 2020	--



P: \100\100.060\drainage\soil maps.dwg May 04, 2020 - 2:03pm

CORE ENGINEERING GROUP

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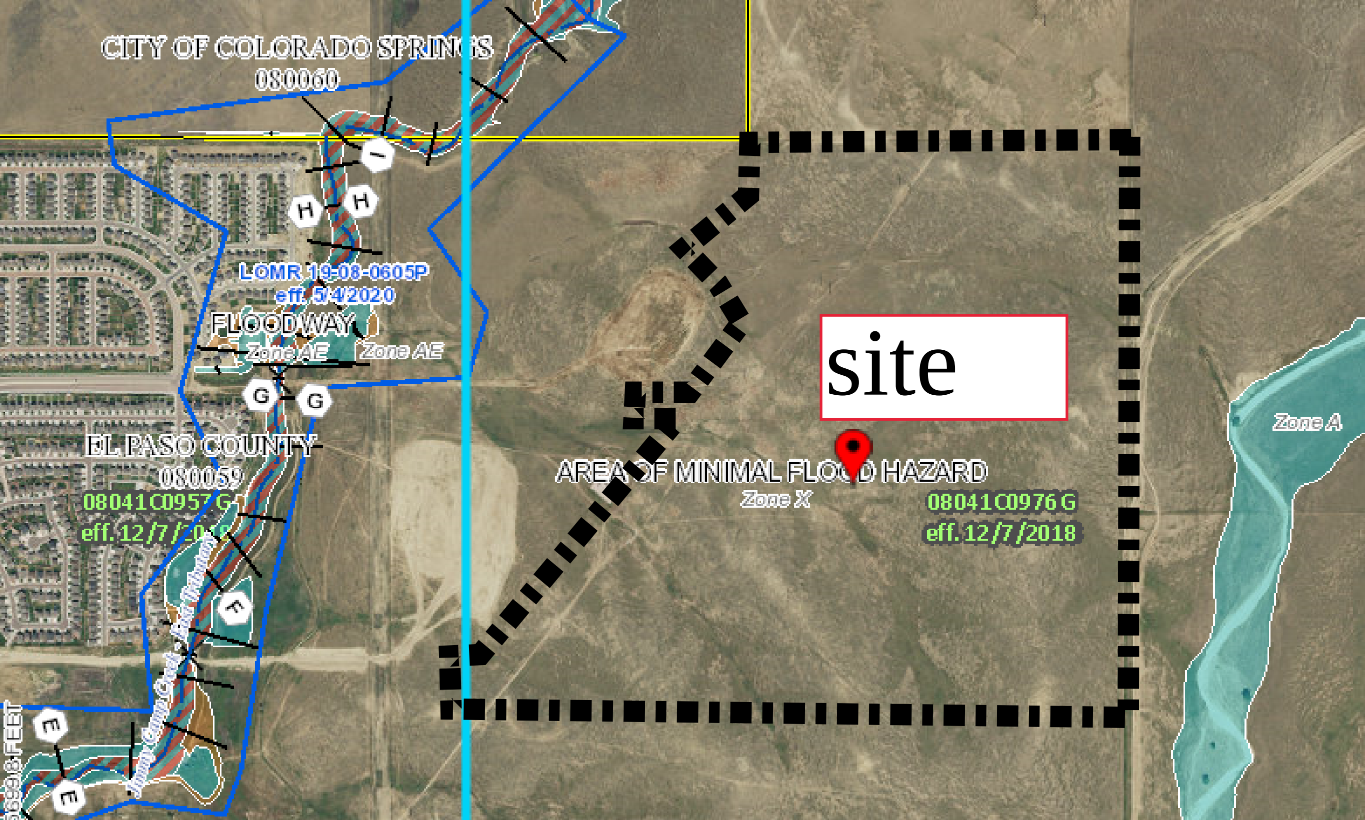
EMAIL: Rich@ceg1.com

THE HILLS AT LORSON RANCH
SOILS MAP

SCALE:	DATE:	FIGURE NO.
NTS	MAY, 2020	--



CITY OF COLORADO SPRINGS
080060
LOMR 19-08-0605P
eff. 5/4/2020
FLOODWAY
Zone AE
Zone AE
EL PASO COUNTY
080059
08041C0957G
site
AREA OF MINIMAL FLOOD HAZARD
Zone X
08041C0976G
eff. 12/7/2018
Zone A

APPENDIX B – HYDROLOGY CALCULATIONS

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: April 8, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **5 - Year Event (Existing)**

Street or Basin	Design Point	Area Design	Direct Runoff						Total Runoff				Street		Pipe			Travel Time			Remarks
			Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C1.1-ex			12.49	0.09	23.8	1.12	2.83	3.2													
C1.2-ex			46.00	0.09	28.5	4.14	2.56	10.6													
C1-ex	**1X**	58.49							35.5	5.26	2.23	11.7									
C2.1-ex			26.58	0.10	33.6	2.66	2.31	6.1													
C2.2-ex			60.28	0.09	35.1	5.43	2.25	12.2													
C2.3-ex			25.65	0.13	32.5	3.33	2.36	7.9													
C2.4-ex			11.14	0.16	37.4	1.78	2.15	3.8													
C2-ex	**2X**	123.65							44.9	13.20	1.88	24.8									
C3.1-ex			8.36	0.12	28.6	1.00	2.55	2.6													
C3.2-ex			18.79	0.16	29.6	3.01	2.50	7.5													
C3-ex	**3X**	27.15							43.4	4.01	1.93	7.7									
C4.1-ex			4.39	0.10	20.9	0.44	3.03	1.3													
C4.2-ex			47.93	0.13	31.6	6.23	2.41	15.0													
C4-ex	**4X**	52.32							34.1	6.67	2.29	15.3									
C5.1-ex			4.81	0.11	21.6	0.53	2.97	1.6													
C5.2-ex			13.32	0.09	25.8	1.20	2.71	3.2													
C5-ex	**5X**	18.13							31.5	1.73	2.41	4.2									
C6-ex	**6X**		14.92	0.14	20.9	2.09	3.03	6.3													
D1-ex			12.58	0.09	33.9	1.13	2.30	2.6													
D2-ex			6.44	0.09	27.8	0.58	2.59	1.5													
D1&D2-ex	**7X**	19.02							33.9	1.71	2.30	3.9									

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: April 8, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **100-Year Event (Existing)**

Street or Basin	Design Point	Area Design	Direct Runoff: Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	Total Runoff: tc	Σ (CA)	i	Q	Street: Slope	Street Flow	Pipe: Design Flow	Slope	Pipe Size	Travel Time: Length	Velocity	tt	Remarks
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C1.1-ex			12.49	0.36	23.8	4.50	4.75	21.4													
C1.2-ex			46.00	0.36	28.5	16.56	4.30	71.2													
C1-ex	**1X**	58.49							35.5	21.06	3.74	78.8									
C2.1-ex			26.58	0.39	33.6	10.37	3.88	40.2													
C2.2-ex			60.28	0.36	35.1	21.70	3.77	81.8													
C2.3-ex			25.65	0.45	32.5	11.54	3.96	45.7													
C2.4-ex			11.14	0.51	37.4	5.68	3.61	20.5													
C2-ex	**2X**	123.65							44.9	49.29	3.15	155.1									
C3.1-ex			8.36	0.42	28.6	3.51	4.28	15.0													
C3.2-ex			18.79	0.51	29.6	9.58	4.20	40.2													
C3-ex	**3X**	27.15							43.4	13.09	3.24	42.4									
C4.1-ex			4.39	0.39	20.9	1.71	5.08	8.7													
C4.2-ex			47.93	0.44	31.6	21.09	4.04	85.1													
C4-ex	**4X**	52.32							34.1	22.80	3.84	87.7									
C5.1-ex			4.81	0.40	21.6	1.92	4.99	9.6													
C5.2-ex			13.32	0.36	25.8	4.80	4.54	21.8													
C5-ex	**5X**	18.13							31.5	6.72	4.05	27.2									
C6-ex	**6X**		14.92	0.47	20.9	7.01	5.08	35.6													
D1-ex			12.58	0.36	33.9	4.53	3.86	17.5													
D2-ex			6.44	0.36	27.8	2.32	4.36	10.1													
D1&D2-ex	**7X**	19.02							33.9	6.85	3.86	26.4									

CORE
ENGINEERING GROUP

15004 1st Avenue South
Burnsville, MN 55306

PROJECT NAME: The Hills at Lorson Ranch
PROJECT NUMBER: 100.061
ENGINEER: LAB
DATE: April 7, 2020

Preliminary Drainage Plan
CURRENT CONDITIONS COEFFICIENT "C" CALCULATIONS

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	Impervious	Type of Cover
C2.1-ex	56	B	20.95	78.82%	0.09	0.07	0.36	0.28	100%	Undeveloped
	52/54	C	5.63	21.18%	0.16	0.03	0.51	0.11	80%	Undeveloped
			26.58	100.00%		0.10		0.39		
C2.2-ex	56	B	58.51	97.06%	0.09	0.09	0.36	0.35	10%	Undeveloped
	52	C	1.77	2.94%	0.16	0.00	0.51	0.01	10%	Undeveloped
			60.28	100.00%		0.09		0.36		
C2.3-ex	56	B	10.52	41.01%	0.09	0.04	0.36	0.15	10%	Undeveloped
	52/75	C/D	15.13	58.99%	0.16	0.09	0.51	0.30	10%	Undeveloped
			25.65	100.00%		0.13		0.45		
C3.1-ex	56	B	4.95	59.21%	0.09	0.05	0.36	0.21	10%	Undeveloped
	54	D	3.41	40.79%	0.16	0.07	0.51	0.21	10%	Undeveloped
			8.36	100.00%		0.12		0.42		
C4.1-ex	56	B	3.54	80.64%	0.09	0.07	0.36	0.29	10%	Undeveloped
	75	D	0.85	19.36%	0.16	0.03	0.51	0.10	10%	Undeveloped
			4.39	100.00%		0.10		0.39		
C4.2-ex	56/108	B	21.23	44.29%	0.09	0.04	0.36	0.16	10%	Undeveloped
	52/54/75	D	26.70	55.71%	0.16	0.09	0.51	0.28	10%	Undeveloped
			47.93	100.00%		0.13		0.44		
C5.1-ex	56	B	3.37	70.06%	0.09	0.06	0.36	0.25	10%	Undeveloped
	75	D	1.44	29.94%	0.16	0.05	0.51	0.15	10%	Undeveloped
			4.81	100.00%		0.11		0.40		
C5.2-ex	56	B	13.01	97.67%	0.09	0.09	0.36	0.35	10%	Undeveloped
	75	D	0.31	2.33%	0.16	0.00	0.51	0.01	10%	Undeveloped
			13.32	100.00%		0.09		0.36		
C6-ex	56	B	4.17	27.95%	0.09	0.03	0.36	0.10	10%	Undeveloped
	52/75	C	10.75	72.05%	0.16	0.12	0.51	0.37	10%	Undeveloped
			14.92	100.00%		0.14		0.47		

CORE
ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Current

Calculated By: Leonard Beasley
Date: April 8, 2019
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
C1.1-ex	0.09	12.49	7.0	300.00	5.40%	0.28	18.16	434.00	5.50%	1.64	4.41		
			15.0					225.00	4.44%	3.16	1.19	23.75	23.75
C1.2-ex	0.09	46.00	7.0	300.00	5.88%	0.28	17.65	346.00	5.88%	1.70	3.40		
			15.0					1100.00	2.73%	2.48	7.40	28.45	28.45
(C1-ex) 1X	0.09	58.49	7.0	300.00	5.40%	0.28	18.16	434.00	5.50%	1.64	4.41		
			15.0					2015.00	3.00%	2.60	12.93	35.49	35.49
C2.1-ex	0.10	26.58	7.0	300.00	5.33%	0.28	18.06	1347.00	5.72%	1.67	13.41		
			15.0					266.00	1.88%	2.06	2.16	33.62	33.62
C2.2-ex	0.09	60.28	7.0	140.00	3.57%	0.16	14.22	1216.00	4.28%	1.45	13.99		
			15.0					1123.00	3.29%	2.72	6.88	35.10	35.10
C2.3-ex	0.13	25.65	7.0	300.00	4.80%	0.28	18.13	685.00	4.90%	1.55	7.37		
			15.0					880.00	1.93%	2.08	7.04	32.54	32.54
C2.4-ex	0.16	11.14	7.0	300.00	3.20%	0.25	20.09	1102.00	3.24%	1.26	14.58		
			15.0					344.00	2.03%	2.14	2.68	37.35	37.35
(C2-ex) 2X	0.11	123.65	7.0	140.00	3.57%	0.17	13.94	1216.00	4.28%	1.45	13.99		
			15.0					1123.00	3.29%	2.72	6.88		
			15.0					1333.00	2.15%	2.20	10.10	44.92	44.92
C3.1-ex	0.12	8.36	7.0	300.00	6.00%	0.29	17.01	1052.00	6.10%	1.73	10.14		
			15.0					152.00	1.32%	1.72	1.47	28.63	28.63
C3.2-ex	0.16	18.79	7.0	220.00	4.09%	0.23	15.87	670.00	2.54%	1.12	10.01		
			15.0					553.00	2.71%	2.47	3.73	29.61	29.61
(C3-ex) 3X	0.15	27.15	7.0	300.00	6.00%	0.30	16.49	1055.00	6.10%	1.73	10.17		
			15.0					152.00	1.32%	1.72	1.47		
			7.0					824.00	2.91%	1.19	11.50		
			15.0					553.00	2.71%	2.47	3.73	43.37	43.37
C4.1-ex	0.10	4.39	7.0	300.00	4.50%	0.26	19.10	143.00	4.60%	1.50	1.59	20.68	20.68
C4.2-ex	0.13	47.93	7.0	300.00	5.25%	0.28	17.60	500.00	5.25%	1.60	5.20		
			15.0					1307.00	2.75%	2.49	8.76	31.55	31.55
(C4-ex) 4X	0.13	52.32	7.0	300.00	4.50%	0.27	18.52	143.00	4.60%	1.50	1.59		
			7.0					500.00	5.25%	1.60	5.20		
			15.0					1307.00	2.75%	2.49	8.76	34.06	34.06
C5.1-ex	0.11	4.81	7.0	300.00	4.80%	0.27	18.51	285.00	4.80%	1.53	3.10	21.60	21.60
C5.2-ex	0.09	13.32	7.0	300.00	4.80%	0.26	18.88	644.00	4.90%	1.55	6.93	25.81	25.81
(C5-ex) 5X	0.10	18.13	7.0	300.00	4.80%	0.27	18.69	285.00	4.80%	1.53	3.10		
			15.0					940.00	1.17%	1.62	9.66	31.45	31.45
(C6-ex) 6X	0.14	14.92	7.0	112.00	5.36%	0.18	10.57	362.00	3.04%	1.22	4.94		
			15.0					592.00	1.52%	1.85	5.34	20.85	20.85
D1-ex	0.09	12.58	7.0	215.00	2.33%	0.18	20.30	1084.00	4.43%	1.47	12.26		
			15.0					215.00	3.26%	2.71	1.32	33.89	33.89
D2-ex	0.09	6.44	7.0	152.00	3.29%	0.17	15.23	1030.00	3.80%	1.36	12.58	27.81	27.81
(D1&2-ex) 7X	0.09	19.02	7.0	215.00	2.33%	0.18	20.30	1084.00	4.43%	1.47	12.26		
			15.0					215.00	3.26%	2.71	1.32	33.89	33.89

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **5 - Year Event (Proposed)**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C1.1			1.38	0.45	11.0	0.62	3.98	2.5													
C1.2			1.06	0.45	6.5	0.48	4.77	2.3													
C1.3			13.47	0.45	26.0	6.06	2.69	16.3													
C1.4			5.19	0.45	12.7	2.34	3.78	8.8													
C1.1-C1.4	1	21.10							26.0	9.50	2.69	25.6									
C1.5			0.70	0.45	9.5	0.32	4.21	1.3													
C1.1-C1.5	2	21.80							26.3	9.81	2.68	26.3									
C1.6			9.35	0.45	20.5	4.21	3.05	12.8													
C1.7			3.18	0.45	12.6	1.43	3.78	5.4													
C1.8			5.59	0.45	18.4	2.52	3.21	8.1													
C1.6-C1.8	3	18.12							28.2	8.15	2.58	21.0									
C1.1-C1.8	4	39.92							28.2	17.96	2.57	46.2									
C2.1			2.18	0.45	16.4	0.98	3.39	3.3													
C2.2			3.81	0.45	14.8	1.71	3.55	6.1													
C2.3			4.79	0.45	13.4	2.16	3.69	8.0													
C2.1-C2.3	5	10.78							17.0	4.85	3.33	16.2									
C2.4			2.86	0.45	8.7	1.29	4.35	5.6													
C2.1-C2.4	6	13.64							18.2	6.14	3.23	19.9									
C2.5			6.42	0.45	18.4	2.89	3.22	9.3													
C2.6			0.43	0.45	7.8	0.19	4.51	0.9													
C2.7			3.31	0.45	11.7	1.49	3.89	5.8													
C2.5-C2.7	7	10.16							20.5	4.57	3.05	13.9									
C2.1-C2.7	8	23.80							20.6	10.71	3.05	32.6									
C2.8			1.78	0.45	9.4	0.80	4.22	3.4													
C2.9			2.73	0.45	13.9	1.23	3.64	4.5													
C2.8-C2.9	9	4.51							13.9	2.03	3.64	7.4									
C2.10			1.70	0.45	13.5	0.77	3.68	2.8													
C2.8-C2.10	10	6.21							14.0	2.79	3.62	10.1									
C2.11			6.29	0.23	15.6	1.45	3.47	5.0													
C2.1-C2.11	11	36.30							27.3	14.95	2.62	39.2									
C3.1			55.11	0.45	20.4	24.80	3.06	75.9													
C4.1			4.61	0.45	17.7	2.07	3.27	6.8													
C4.2			3.66	0.45	10.3	1.65	4.08	6.7													
C4.1-C4.2	12	8.27							19.7	3.72	3.12	11.6									
C4.3			2.61	0.46	14.3	1.20	3.59	4.3													
C4.4			2.99	0.46	9.8	1.38	4.15	5.7													
C4.1-C4.4	13	13.87							21.1	6.30	3.01	19.0									
C4.5			0.63	0.90	5.0	0.57	5.17	2.9													
C4.1-C4.5	14	14.50							21.2	6.86	3.00	20.6									

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **5 - Year Event (Proposed)**

Street or Basin	Design Point	Area Design	Direct Runoff: Area (A)	Direct Runoff: Runoff Coeff. (C)	Direct Runoff: tc	Direct Runoff: CA	Direct Runoff: i	Direct Runoff: Q	Total Runoff: tc	Total Runoff: Σ (CA)	Total Runoff: i	Total Runoff: Q	Street: Slope	Street: Street Flow	Pipe: Design Flow	Pipe: Slope	Pipe: Pipe Size	Travel Time: Length	Travel Time: Velocity	Travel Time: tt	Remarks
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C4.6			3.69	0.32	13.6	1.18	3.67	4.3													
C4.1-C4.6	**15**	18.19							30.6	8.05	2.45	19.7									
C5.1			25.14	0.46	13.7	11.56	3.65	42.3													
C5.2			1.71	0.49	8.5	0.84	4.37	3.7													
C5.3			2.26	0.46	10.3	1.04	4.09	4.2													
C5.2-C5.3	**16**	3.97							10.3	1.88	4.09	7.7									
C5.4			0.73	0.90	5.0	0.66	5.17	3.4													
C5.2-C5.4	**17**	4.70							9.6	2.53	4.19	10.6									
C5.1-C5.4	**18**	29.84							13.7	14.10	3.66	51.6									
C5.5			2.27	0.49	9.5	1.11	4.21	4.7													
C5.1-C5.5	**19**	32.11							15.1	15.21	3.51	53.4									
C6.1			1.21	0.45	5.7	0.54	4.98	2.7													
C6.2			4.35	0.45	17.6	1.96	3.28	6.4													
C6.1-C6.2	**20**	5.56							17.6	2.50	3.28	8.2									
C6.3			0.56	0.45	8.4	0.25	4.39	1.1													
C6.1-C6.3	**21**	6.12							17.8	2.75	3.26	9.0									
C6.4			4.02	0.45	13.0	1.81	3.73	6.8													
C6.5			0.33	0.47	7.1	0.16	4.64	0.7													
C6.4-C6.5	**22**	4.35							17.6	1.96	3.28	6.4									
C6.6			1.44	0.90	5.8	1.30	4.96	6.4													
C6.1-C6.6	**24**	11.91							17.7	6.01	3.28	19.7									
C6.7			3.83	0.32	12.2	1.23	3.83	4.7													
C6.1-C6.7	**25**	15.74							18.1	7.24	3.24	23.5									
C7.1			2.35	0.49	8.5	1.15	4.38	5.0													
C7.2			0.84	0.49	9.9	0.41	4.14	1.7													
C7.3			1.99	0.49	9.3	0.98	4.25	4.1													
C7.1-C7.3	**26**	5.18							9.3	2.54	4.25	10.8									
C7.4			2.71	0.49	14.5	1.33	3.58	4.7													
C7.5			0.50	0.49	7.5	0.25	4.57	1.1													
C7.4-C7.5	**27**	3.21							14.5	1.57	3.58	5.6									
C7.1-C7.5	**28**	8.39							14.5	4.11	3.58	14.7									
C7.6			4.42	0.24	13.2	1.06	3.72	3.9													
C7.1-C7.6	**29**	12.81							16.5	5.17	3.38	17.5									
C8.1			8.11	0.46	13.2	3.73	3.71	13.9													
C8.2			2.12	0.49	8.9	1.04	4.31	4.5													
C4.1-ex			4.39	0.10	20.9	0.44	3.03	1.3													
C8.3			16.38	0.47	21.5	7.70	2.98	23.0													
C4.1-ex & C8.3	**30**	20.77							21.5	8.14	2.98	24.3									
C8.1-C8.3 & C4.1-ex		31.00							24.0	12.91	2.82	36.4									

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **5 - Year Event (Proposed)**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C8.4			6.70	0.46	9.0	3.08	4.28	13.2													
C8.1-C8.4 & C4.1-ex	32	37.70							24.0	15.99	2.82	45.1									
C8.5			3.49	0.49	8.7	1.71	4.34	7.4													
C8.6			0.79	0.90	5.3	0.71	5.08	3.6													
C8.5-C8.6	33	4.28							21.1	2.42	3.01	7.3									
C8.7			23.61	0.48	25.4	11.33	2.73	30.9													
C8.5-C8.7		27.89							25.4	13.75	2.73	37.6									
C8.8			7.80	0.22	15.6	1.72	3.46	5.9													
C8.1-C8.8	35	73.39							27.5	31.46	2.61	82.2									
C10.1			2.65	0.49	7.0	1.30	4.66	6.1													
C10.2			0.50	0.49	6.9	0.25	4.69	1.1													
C10.3			0.26	0.49	6.8	0.13	4.71	0.6													
C10.1-C10.3	36	3.41							9.0	1.67	4.28	7.2									
C10.4			2.64	0.49	10.7	1.29	4.03	5.2													
C10.1-C10.4	37	6.05							10.8	2.96	4.02	11.9									
C10.5			0.90	0.48	10.1	0.43	4.12	1.8													
C10.6			0.56	0.49	6.1	0.27	4.88	1.3													
C5.1-ex			4.81	0.11	21.6	0.53	2.97	1.6													
C10.7			3.36	0.45	16.9	1.51	3.34	5.0													
C5.1-ex & C10.7	38	8.17							16.9	2.04	3.34	6.8									
C10.8			1.89	0.45	11.2	0.85	3.95	3.4													
C10.7-C10.8 & C5.1-ex	39	10.06							20.6	2.89	3.05	8.8									
C10.9			3.73	0.46	15.7	1.72	3.45	5.9													
C10.6-C10.9 & C5.1-ex	40	14.35							21.1	4.88	3.01	14.7									
C10.10			6.86	0.45	13.2	3.09	3.72	11.5													
C10.11			9.10	0.29	13.9	2.64	3.63	9.6													
C10		37.26							23.3	14.00	2.86	40.1									
C12.1	41		1.23	0.48	10.5	0.59	4.05	2.4													
C12.2			2.69	0.49	12.3	1.32	3.82	5.0													
C12.3			0.76	0.49	9.4	0.37	4.23	1.6													
C12.2-C12.3	42	3.45							12.8	1.69	3.76	6.4									
C12.4			1.58	0.49	11.5	0.77	3.92	3.0													
C12.5			2.60	0.49	16.7	1.27	3.36	4.3													
C12.2-C12.5	43	7.63							16.7	3.74	3.36	12.6									
C12.6			1.85	0.47	7.7	0.87	4.52	3.9													
C12.7			2.09	0.45	13.2	0.94	3.71	3.5													
C12.8			0.54	0.76	5.0	0.41	5.17	2.1													
C12.6-C12.8	44	4.48							13.2	2.22	3.71	8.2									
C12.1-C12.8	45	13.34							16.7	6.55	3.36	22.0									

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **5 - Year Event (Proposed)**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C12.9			0.47	0.49	8.2	0.23	4.42	1.0													
C12.10			0.87	0.49	7.3	0.43	4.60	2.0													
C12.9-C12.10	**46**	1.34							9.3	0.66	4.24	2.8									
C12.11			0.86	0.49	8.2	0.42	4.42	1.9													
D1.1			2.23	0.45	7.5	1.00	4.56	4.6													
D1.2			3.44	0.45	12.2	1.55	3.83	5.9													
D1.3			0.88	0.75	6.3	0.66	4.82	3.2													
D1.4			1.92	0.45	10.8	0.86	4.02	3.5													
D1.1-D1.4	**47**	8.47							12.4	4.08	3.81	15.5									
D1.5			3.25	0.21	13.0	0.68	3.74	2.6													
D1.6			2.67	0.09	14.2	0.24	3.61	0.9													

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **100 - Year Event (Proposed)**

		Direct Runoff							Total Runoff				Street		Pipe			Travel Time			
Street or Basin	Design Point	Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	Remarks
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C1.1			1.38	0.59	11.0	0.81	6.69	5.4													
C1.2			1.06	0.59	6.5	0.63	8.01	5.0													
C1.3			13.47	0.59	26.0	7.95	4.52	35.9													
C1.4			5.19	0.59	12.7	3.06	6.34	19.4													
C1.1-C1.4	1	21.10							26.0	12.45	4.52	56.3									
C1.5			0.70	0.59	9.5	0.41	7.07	2.9													
C1.1-C1.5	2	21.80							26.3	12.86	4.50	57.8									
C1.6			9.35	0.59	20.5	5.52	5.12	28.3													
C1.7			3.18	0.59	12.6	1.88	6.34	11.9													
C1.8			5.59	0.59	18.4	3.30	5.39	17.8													
C1.6-C1.8	3	18.12							28.2	10.69	4.32	46.2									
C1.1-C1.8	4	39.92							28.2	23.55	4.32	101.7									
C2.1			2.18	0.59	16.4	1.29	5.69	7.3													
C2.2			3.81	0.59	14.8	2.25	5.95	13.4													
C2.3			4.79	0.59	13.4	2.83	6.20	17.5													
C2.1-C2.3	5	10.78							17.0	6.36	5.59	35.5									
C2.4			2.86	0.59	8.7	1.69	7.30	12.3													
C2.1-C2.4	6	13.64							18.2	8.05	5.43	43.7									
C2.5			6.42	0.59	18.4	3.79	5.40	20.5													
C2.6			0.43	0.59	7.8	0.25	7.57	1.9													
C2.7			3.31	0.59	11.7	1.95	6.54	12.8													
C2.5-C2.7	7	10.16							20.5	5.99	5.12	30.7									
C2.1-C2.7	8	23.80							20.6	14.04	5.11	71.8									
C2.8			1.78	0.59	9.4	1.05	7.08	7.4													
C2.9			2.73	0.59	13.9	1.61	6.10	9.8													
C2.8-C2.9	9	4.51							13.9	2.66	6.10	16.2									
C2.10			1.70	0.59	13.5	1.00	6.19	6.2													
C2.8-C2.10	10	6.21							14.0	3.66	6.08	22.3									
C2.11			6.29	0.46	15.6	2.89	5.82	16.8													
C2.1-C2.11	11	36.30							27.3	20.60	4.40	90.7									
C3.1			55.11	0.59	20.4	32.51	5.14	167.0													
C4.1			4.61	0.59	17.7	2.72	5.49	14.9													
C4.2			3.66	0.59	10.3	2.16	6.86	14.8													
C4.1-C4.2	12	8.27							19.7	4.88	5.23	25.5									

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **100 - Year Event (Proposed)**

Street or Basin	Design Point	Area Design	Direct Runoff: Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	Total Runoff: tc	Σ (CA)	i	Q	Street: Slope	Street Flow	Pipe: Design Flow	Slope	Pipe Size	Travel Time: Length	Velocity	tt	Remarks
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C4.3			2.61	0.60	14.3	1.57	6.03	9.4													
C4.4			2.99	0.60	9.8	1.79	6.98	12.5													
C4.1-C4.4	**13**	13.87							21.1	8.24	5.05	41.6									
C4.5			0.63	0.96	5.0	0.60	8.68	5.2													
C4.1-C4.5	**14**	14.50							21.2	8.84	5.03	44.5									
C4.6			3.69	0.65	13.6	2.40	6.16	14.8													
C4.1-C4.6	**15**	18.19							30.6	11.24	4.11	46.2									
C5.1			25.14	0.60	13.7	15.08	6.14	92.5													
C5.2			1.71	0.65	8.5	1.11	7.33	8.2													
C5.3			2.26	0.61	10.3	1.38	6.86	9.5													
C5.2-C5.3	**16**	3.97							10.3	2.49	6.86	17.1									
C5.4			0.73	0.96	5.0	0.70	8.68	6.1													
C5.2-C5.4	**17**	4.70							9.6	3.19	7.03	22.4									
C5.1-C5.4	**18**	29.84							13.7	18.27	6.15	112.3									
C5.5			2.27	0.65	9.5	1.48	7.06	10.4													
C5.1-C5.5	**19**	32.11							15.1	19.75	5.90	116.4									
C6.1			1.21	0.59	5.7	0.71	8.36	6.0													
C6.2			4.35	0.59	17.6	2.57	5.51	14.1													
C6.1-C6.2	**20**	5.56							17.6	3.28	5.51	18.1									
C6.3			0.56	0.59	8.4	0.33	7.37	2.4													
C6.1-C6.3	**21**	6.12							17.8	3.61	5.48	19.8									
C6.4			4.02	0.60	13.0	2.41	6.27	15.1													
C6.5			0.33	0.62	7.1	0.20	7.78	1.6													
C6.4-C6.5	**22**	4.35							17.6	2.62	5.51	14.4									
C6.6			1.44	0.96	5.8	1.38	8.32	11.5													
C6.1-C6.6	**24**	11.91							17.7	7.61	5.50	41.8									
C6.7			3.83	0.56	12.2	2.14	6.42	13.8													
C6.1-C6.7	**25**	15.74							18.1	9.75	5.44	53.1									
C7.1			2.35	0.65	8.5	1.53	7.35	11.2													
C7.2			0.84	0.65	9.9	0.55	6.95	3.8													
C7.3			1.99	0.65	9.3	1.29	7.13	9.2													
C7.1-C7.3	**26**	5.18							9.3	3.37	7.13	24.0									
C7.4			2.71	0.65	14.5	1.76	6.00	10.6													
C7.5			0.50	0.65	7.5	0.33	7.67	2.5													

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

CORE ENGINEERING GROUP

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Date: April 17, 2020
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Job No: 100.061
Project: The Hills at Lorson Ranch
Design Storm: **100 - Year Event (Proposed)**

Street or Basin	Design Point	Area Design	Direct Runoff						Total Runoff				Street		Pipe			Travel Time			Remarks
			Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C7.4-C7.5	**27**	3.21							14.5	2.09	6.00	12.5									
C7.1-C7.5	**28**	8.39							14.5	5.45	6.00	32.7									
C7.6			4.42	0.55	13.2	2.43	6.24	15.2													
C7.1-C7.6	**29**	12.81							16.5	7.88	5.67	44.7									
C8.1			8.11	0.61	13.2	4.95	6.24	30.9													
C8.2			2.12	0.65	8.9	1.38	7.23	10.0													
C4.1-ex			4.39	0.39	20.9	1.71	5.08	8.7													
C8.3			16.38	0.62	21.5	10.16	5.01	50.8													
C4.1-ex & C8.3	**30**	20.77							21.5	11.87	5.01	59.4									
C8.1-C8.3 & C4.1-ex		31.00							24.0	18.19	4.73	86.0									
C8.4			6.70	0.61	9.0	4.09	7.19	29.4													
C8.1-C8.4 & C4.1-ex	**32**	37.70							24.0	22.28	4.73	105.4									
C8.5			3.49	0.65	8.7	2.27	7.28	16.5													
C8.6			0.79	0.96	5.3	0.76	8.53	6.5													
C8.5-C8.6	**33**	4.28							21.1	3.03	5.05	15.3									
C8.7			23.61	0.64	25.4	15.11	4.58	69.2													
C8.5-C8.7		27.89							25.4	18.14	4.58	83.1									
C8.8			7.80	0.48	15.6	3.74	5.81	21.8													
C8.1-C8.8	**35**	73.39							27.5	44.16	4.39	193.7									
C10.1			2.65	0.65	7.0	1.72	7.83	13.5													
C10.2			0.50	0.65	6.9	0.33	7.88	2.6													
C10.3			0.26	0.65	6.8	0.17	7.92	1.3													
C10.1-C10.3	**36**	3.41							9.0	2.22	7.19	15.9									
C10.4			2.64	0.65	10.7	1.72	6.76	11.6													
C10.1-C10.4	**37**	6.05							10.8	3.93	6.75	26.5									
C10.5			0.90	0.64	10.1	0.58	6.92	4.0													
C10.6			0.56	0.65	6.1	0.36	8.19	3.0													
C5.1-ex			4.81	0.40	21.6	1.92	4.99	9.6													
C10.7			3.36	0.59	16.9	1.98	5.60	11.1													
C5.1-ex & C10.7	**38**	8.17							16.9	3.91	5.60	21.9									
C10.8			1.89	0.59	11.2	1.12	6.64	7.4													
C10.7-C10.8 & C5.1-ex	**39**	10.06							20.6	5.02	5.12	25.7									
C10.9			3.73	0.60	15.7	2.24	5.79	13.0													
C10.6-C10.9 & C5.1-ex	**40**	14.35							21.1	7.62	5.05	38.5									

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Street or Basin	Design Point	Area Design	Direct Runoff: Area (A)	Direct Runoff: Runoff Coeff. (C)	Direct Runoff: tc	Direct Runoff: CA	Direct Runoff: i	Direct Runoff: Q	Total Runoff: tc	Total Runoff: Σ (CA)	Total Runoff: i	Total Runoff: Q	Street: Slope	Street: Street Flow	Pipe: Design Flow	Pipe: Slope	Pipe: Pipe Size	Travel Time: Length	Travel Time: Velocity	Travel Time: tt	Remarks
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C10.10			6.86	0.59	13.2	4.05	6.24	25.3													
C10.11			9.10	0.57	13.9	5.19	6.10	31.6													
C10		37.26							23.3	21.37	4.80	102.6									
C12.1	**41**		1.23	0.64	10.5	0.79	6.80	5.4													
C12.2			2.69	0.65	12.3	1.75	6.41	11.2													
C12.3			0.76	0.65	9.4	0.49	7.10	3.5													
C12.2-C12.3	**42**	3.45							12.8	2.24	6.31	14.1									
C12.4			1.58	0.65	11.5	1.03	6.58	6.8													
C12.5			2.60	0.65	16.7	1.69	5.64	9.5													
C12.2-C12.5	**43**	7.63							16.7	4.96	5.64	28.0									
C12.6			1.85	0.62	7.7	1.15	7.59	8.7													
C12.7			2.09	0.59	13.2	1.23	6.24	7.7													
C12.8			0.54	0.84	5.0	0.45	8.68	3.9													
C12.6-C12.8	**44**	4.48							13.2	2.83	6.24	17.7									
C12.1-C12.8	**45**	13.34							16.7	8.58	5.64	48.4									
C12.9			0.47	0.65	8.2	0.31	7.42	2.3													
C12.10			0.87	0.65	7.3	0.57	7.72	4.4													
C12.9-C12.10	**46**	1.34							9.3	0.87	7.12	6.2									
C12.11			0.86	0.65	8.2	0.56	7.42	4.1													
D1.1			2.23	0.59	7.5	1.32	7.66	10.1													
D1.2			3.44	0.59	12.2	2.03	6.43	13.0													
D1.3			0.88	0.84	6.3	0.74	8.10	6.0													
D1.4			1.92	0.59	10.8	1.13	6.74	7.6													
D1.1-D1.4	**47**	8.47							12.4	5.22	6.40	33.4									
D1.5			3.25	0.44	13.0	1.43	6.28	9.0													
D1.6			2.67	0.36	14.2	0.96	6.05	5.8													

CORE ENGINEERING GROUP

15004 1st Avenue South
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Preliminary Drainage Plan
PROPOSED CONDITIONS COEFFICIENT "C" CALCULATIONS

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	Impervious	Type of Cover
C1.1	56	B	1.38		0.45		0.59		65%	1/8 ac. Single Family
C1.2	56	B	1.06		0.45		0.59		65%	1/8 ac. Single Family
C1.3	56	B	13.47		0.45		0.59		65%	1/8 ac. Single Family
C1.4	56	B	5.19		0.45		0.59		65%	1/8 ac. Single Family
C1.5	56	B	0.70		0.45		0.59		65%	1/8 ac. Single Family
C1.6	56/108	B	9.35		0.45		0.59		65%	1/8 ac. Single Family
C1.7	56	B	3.18		0.45		0.59		65%	1/8 ac. Single Family
C1.8	56	B	5.59		0.45		0.59		65%	1/8 ac. Single Family
C2.1	56	B	2.18		0.45		0.59		65%	1/8 ac. Single Family
C2.2	56	B	3.81		0.45		0.59		65%	1/8 ac. Single Family
C2.3	56	B	4.79		0.45		0.59		65%	1/8 ac. Single Family
C2.4	56	B	2.86		0.45		0.59		65%	1/8 ac. Single Family
C2.5	56	B	6.42		0.45		0.59		65%	1/8 ac. Single Family
C2.6	56	B	0.43		0.45		0.59		65%	1/8 ac. Single Family
C2.7	56	B	3.31		0.45		0.59		65%	1/8 ac. Single Family
C2.8	56	B	1.78		0.45		0.59		65%	1/8 ac. Single Family
C2.9	56	B	2.73		0.45		0.59		65%	1/8 ac. Single Family
C2.10	56	B	1.70		0.45		0.59		65%	1/8 ac. Single Family
C2.11	56	B	4.69	74.56%	0.16	0.12	0.41	0.31	13%	Pond / Open Space
	56	B	1.60	25.44%	0.45	0.11	0.59	0.15	65%	1/8 ac. Single Family
			6.29	100.00%		0.23		0.46		
C3.1	56	B	55.11		0.45		0.59		65%	1/8 ac. Single Family
C4.1	56	B	4.61		0.45		0.59		65%	1/8 ac. Single Family
C4.2	56	B	3.66		0.45		0.59		65%	1/8 ac. Single Family
C4.3	56	B	2.04	78.16%	0.45	0.35	0.59	0.46	65%	1/8 ac. Single Family
	52	C	0.57	21.84%	0.49	0.11	0.65	0.14	65%	1/8 ac. Single Family
			2.61	100.00%		0.46		0.60		
C4.4	56	B	2.29	76.59%	0.45	0.34	0.59	0.45	65%	1/8 ac. Single Family
	52	C	0.70	23.41%	0.49	0.11	0.65	0.15	65%	1/8 ac. Single Family
			2.99	100.00%		0.46		0.60		
C4.5	56	B	0.26	41.27%	0.90	0.37	0.96	0.40	100%	Roadway
	52	C	0.37	58.73%	0.90	0.53	0.96	0.56	100%	Roadway
			0.63	100.00%		0.90		0.96		
C4.6	52	C	2.34	63.41%	0.23	0.15	0.54	0.34	13%	Pond / Open Space
	56	B	0.32	8.67%	0.45	0.04	0.59	0.05	65%	1/8 ac. Single Family
	52	C	1.03	27.91%	0.49	0.14	0.65	0.18	65%	1/8 ac. Single Family

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			3.69	100.00%		0.32		0.58		
C5.1	56	B	21.87	86.99%	0.45	0.39	0.59	0.51	65%	1/8 ac. Single Family
	52	C	3.27	13.01%	0.49	0.06	0.65	0.08	65%	1/8 ac. Single Family
			25.14	100.00%		0.46		0.60		
C5.2	52	C	1.71		0.49		0.65		65%	1/8 ac. Single Family
C5.3	56	B	1.50	66.37%	0.45	0.30	0.59	0.39	65%	1/8 ac. Single Family
	52	C	0.76	33.63%	0.49	0.16	0.65	0.22	65%	1/8 ac. Single Family
			2.26	100.00%		0.46		0.61		
C5.4	52	C	0.73		0.90		0.96		100%	Roadway
C5.5	52	C	2.27		0.49		0.65		65%	1/8 ac. Single Family
C6.1	56	B	1.21		0.45		0.59		65%	1/8 ac. Single Family
C6.2	56	B	4.35		0.45		0.59		65%	1/8 ac. Single Family
C6.3	56	B	0.56		0.45		0.59		65%	1/8 ac. Single Family
C6.4	56	B	3.52	87.56%	0.45	0.39	0.59	0.52	65%	1/8 ac. Single Family
	52	C	0.50	12.44%	0.49	0.06	0.65	0.08	65%	1/8 ac. Single Family
			4.02	100.00%		0.45		0.60		
C6.5	56	B	0.14	42.42%	0.45	0.19	0.59	0.25	65%	1/8 ac. Single Family
	52	C	0.19	57.58%	0.49	0.28	0.65	0.37	65%	1/8 ac. Single Family
			0.33	100.00%		0.47		0.62		
C6.6	52	C	1.44		0.90		0.96		100%	Roadway
C6.7	56	B	0.24	6.27%	0.16	0.01	0.41	0.03	13%	Pond / Open Space
	52	C	2.19	57.18%	0.23	0.13	0.54	0.31	13%	Pond / Open Space
	56	B	0.51	13.32%	0.45	0.06	0.59	0.08	65%	1/8 ac. Single Family
	52	C	0.89	23.24%	0.49	0.11	0.65	0.15	65%	1/8 ac. Single Family
			3.83	100.00%		0.32		0.56		
C7.1	54/75	D	2.35		0.49		0.65		65%	1/8 ac. Single Family
C7.2	75	D	0.84		0.49		0.65		65%	1/8 ac. Single Family
C7.3	75	D	1.99		0.49		0.65		65%	1/8 ac. Single Family
C7.4	52/54/75	C/D	2.71		0.49		0.65		65%	1/8 ac. Single Family
C7.5	75	D	0.50		0.49		0.65		65%	1/8 ac. Single Family
C7.6	75	D	0.25	5.66%	0.49	0.03	0.65	0.04	65%	1/8 ac. Single Family
	75	D	4.17	94.34%	0.23	0.22	0.54	0.51	13%	Pond / Open Space
			4.42	100.00%		0.24		0.55		

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C8.1	56	B	5.25	64.73%	0.45	0.29	0.59	0.38	65%	1/8 ac. Single Family
	54	D	2.86	35.27%	0.49	0.17	0.65	0.23	65%	1/8 ac. Single Family
			8.11	100.00%		0.46		0.61		
C8.2	52	C	2.12		0.49		0.65		65%	1/8 ac. Single Family
C4.1-ex	56	B	3.54	80.64%	0.09	0.07	0.36	0.29	2%	Historic / Offsite
	75	D	0.85	19.36%	0.16	0.03	0.51	0.10	2%	Historic / Offsite
			4.39	100.00%		0.10		0.39		
C8.3	56	B	7.50	45.79%	0.45	0.21	0.59	0.27	65%	1/8 ac. Single Family
	54/75	C/D	8.88	54.21%	0.49	0.27	0.65	0.35	65%	1/8 ac. Single Family
			16.38	100.00%		0.47		0.62		
C8.4	56	B	4.89	72.99%	0.45	0.33	0.59	0.43	65%	1/8 ac. Single Family
	54	C	1.81	27.01%	0.49	0.13	0.65	0.18	65%	1/8 ac. Single Family
			6.70	100.00%		0.46		0.61		
C8.5	75	D	3.49		0.49		0.65		100%	1/8 ac. Single Family
C8.6	54	D	0.79		0.90		0.96		100%	Street
C8.7	56	B	3.68	15.59%	0.45	0.07	0.59	0.09	65%	1/8 ac. Single Family
	52/54/75	C/D	19.93	84.41%	0.49	0.41	0.65	0.55	65%	1/8 ac. Single Family
			23.61	100.00%		0.48		0.64		
C8.8	56	B	3.85	49.36%	0.16	0.08	0.41	0.20	13%	Pond / Open Space
	52	C	3.08	39.49%	0.23	0.09	0.54	0.21	13%	Pond / Open Space
	56	B	0.63	8.08%	0.45	0.04	0.59	0.05	65%	1/8 ac. Single Family
	52	C	0.24	3.08%	0.49	0.02	0.65	0.02	65%	1/8 ac. Single Family
			7.80	100.00%		0.22		0.48		
C10.1	54	D	2.65		0.49		0.65		65%	1/8 ac. Single Family
C10.2	52	C	0.50		0.49		0.65		65%	1/8 ac. Single Family
C10.3	52/75	C/D	0.26		0.49		0.65		65%	1/8 ac. Single Family
C10.4	52/54/75	C/D	2.64		0.49		0.65		65%	1/8 ac. Single Family
C10.5	56	B	0.14	15.56%	0.45	0.07	0.59	0.09	65%	1/8 ac. Single Family
	52	C	0.76	84.44%	0.49	0.41	0.65	0.55	65%	1/8 ac. Single Family
			0.90	100.00%		0.48		0.64		
C10.6	52	C	0.56		0.49		0.65		65%	1/8 ac. Single Family
C5.1-ex	56	B	3.37	70.06%	0.09	0.06	0.36	0.25	2%	Historic / Offsite
	75	D	1.44	29.94%	0.16	0.05	0.51	0.15	2%	Historic / Offsite
			4.81	100.00%		0.11		0.40		

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Preliminary Drainage Plan
PROPOSED CONDITIONS COEFFICIENT "C" CALCULATIONS

C10.7	56	B	3.23	96.13%	0.45	0.43	0.59	0.57	65%	1/8 ac. Single Family
	75	D	0.13	3.87%	0.49	0.02	0.65	0.03	65%	1/8 ac. Single Family
			3.36	100.00%		0.45		0.59		
C10.8	56	B	1.89		0.45		0.59		65%	1/8 ac. Single Family
C10.9	56	B	3.17	84.99%	0.45	0.38	0.59	0.50	65%	1/8 ac. Single Family
	52	C	0.56	15.01%	0.49	0.07	0.65	0.10	65%	1/8 ac. Single Family
			3.73	100.00%		0.46		0.60		
C10.10	56	B	6.71	97.81%	0.45	0.44	0.59	0.58	65%	1/8 ac. Single Family
	75	D	0.15	2.19%	0.49	0.01	0.65	0.01	65%	1/8 ac. Single Family
			6.86	100.00%		0.45		0.59		
C10.11	52/75	C/D	6.87	75.49%	0.23	0.17	0.54	0.41	13%	Pond / Open Space
	56	B	0.10	1.10%	0.45	0.00	0.59	0.01	65%	1/8 ac. Single Family
	52	C	2.13	23.41%	0.49	0.11	0.65	0.15	65%	1/8 ac. Single Family
			9.10	100.00%		0.29		0.57		
C12.1	56	B	0.30	24.39%	0.45	0.11	0.59	0.14	65%	1/8 ac. Single Family
	52/75	C/D	0.93	75.61%	0.49	0.37	0.65	0.49	65%	1/8 ac. Single Family
			1.23	100.00%		0.48		0.64		
C12.2	75	D	2.69		0.49		0.65		65%	1/8 ac. Single Family
C12.3	75	D	0.76		0.49		0.65		65%	1/8 ac. Single Family
C12.4	52/75	C/D	1.58		0.49		0.65		65%	1/8 ac. Single Family
C12.5	75	D	2.60		0.49		0.65		65%	1/8 ac. Single Family
C12.6	56	B	0.91	49.19%	0.45	0.22	0.59	0.29	65%	1/8 ac. Single Family
	52	C	0.94	50.81%	0.49	0.25	0.65	0.33	65%	1/8 ac. Single Family
			1.85	100.00%		0.47		0.62		
C12.7	56	B	2.09		0.45		0.59		65%	1/8 ac. Single Family
C12.8	56	B	0.37	68.52%	0.90	0.62	0.96	0.66	65%	Roadway
	56	B	0.17	31.48%	0.45	0.14	0.59	0.19	65%	1/8 ac. Single Family
			0.54	100.00%		0.76		0.84		
C12.9	52/75	C/D	0.47		0.49		0.65		65%	1/8 ac. Single Family
C12.10	75	D	0.87		0.49		0.65		65%	1/8 ac. Single Family
C12.11	75	D	0.86		0.49		0.65		65%	1/8 ac. Single Family
D1.1	56	B	2.23		0.45		0.59		65%	1/8 ac. Single Family
D1.12	56	B	3.44		0.45		0.59		65%	1/8 ac. Single Family
D1.3	56	B	0.29	32.95%	0.45	0.15	0.59	0.19	65%	1/8 ac. Single Family

CORE
ENGINEERING GROUP
15004 1st Avenue South
Burnsville, MN 55306

PROJECT NAME: *The Hills at Lorson Ranch*
PROJECT NUMBER: *100.061*
ENGINEER: *LAB*
DATE: *April 16, 2019*

Preliminary Drainage Plan
PROPOSED CONDITIONS COEFFICIENT "C" CALCULATIONS

	56	B	0.59	67.05%	0.90	0.60	0.96	0.64	65%	Roadway
			0.88	100.00%		0.75		0.84		
D1.4	56	B	1.92		0.45		0.59		65%	1/8 ac. Single Family
D1.5	56	B	2.13	65.54%	0.09	0.06	0.36	0.24	13%	Pond / Open Space
	56	B	1.12	34.46%	0.45	0.16	0.59	0.20	65%	1/8 ac. Single Family
			3.25	100.00%		0.21		0.44		
D1.6	56	B	2.67		0.09		0.36		13%	Pond / Open Space

Standard Form SF-1. Time of Concentration-Proposed

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc $t_c=(L/180)+10$ minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
C1.1	0.45	1.38	20.0	54.00	2.00%	0.13	6.89	170.00	2.60%	3.22	0.88				
			20.0					510.00	1.71%	2.62	3.25	11.02	734.00	14.08	11.02
C1.2	0.45	1.06	7.0	50.00	16.00%	0.25	3.33	70.00	5.57%	1.65	0.71				
			20.0					285.00	0.91%	1.91	2.49	6.53	405.00	12.25	6.53
C1.3	0.45	13.47	7.0	100.00	2.20%	0.18	9.08	70.00	2.40%	1.08	1.08				
			20.0					2805.00	2.17%	2.95	15.87	26.03	2975.00	26.53	26.03
C1.4	0.45	5.19	7.0	80.00	2.00%	0.16	8.38	28.00	2.00%	0.99	0.47				
			20.0					784.00	3.37%	3.67	3.56				
			20.0					72.00	6.00%	4.90	0.24	12.66	964.00	15.36	12.66
DP-1	0.45	21.10	7.0	100.00	2.20%	0.18	9.08	70.00	2.40%	1.08	1.08				
			20.0					2805.00	2.17%	2.95	15.87	26.03	2975.00	26.53	26.03
C1.5	0.45	0.70	20.0	27.00	2.00%	0.09	4.87	650.00	1.38%	2.35	4.61	9.48	677.00	13.76	9.48
DP-2	0.45	21.80	7.0	100.00	2.20%	0.18	9.08	70.00	2.40%	1.08	1.08				
			20.0					2805.00	2.17%	2.95	15.87				
			RCP					115.00	1.00%	7.20	0.27	26.29	3090.00	27.17	26.29
C1.6	0.45	9.35	20.0	81.00	2.90%	0.18	7.46	2102.00	1.80%	2.68	13.06	20.52	2183.00	22.13	20.52
C1.7	0.45	3.18	7.0	40.00	15.50%	0.22	3.01	105.00	6.00%	1.71	1.02				
			20.0					1033.00	1.00%	2.00	8.61	12.64	1178.00	16.54	12.64
C1.8	0.45	5.59	7.0	100.00	2.00%	0.18	9.37	62.00	2.00%	0.99	1.04				
			20.0					1357.00	1.85%	2.72	8.31	18.73	1519.00	18.44	18.44
DP-3	0.45	18.12	20.0	81.00	2.90%	0.18	7.46	3350.00	1.82%	2.70	20.69	28.15	3431.00	29.06	28.15
DP-4	0.45	39.92	7.0	100.00	2.20%	0.18	9.08	70.00	2.40%	1.08	1.08				
			20.0					2805.00	2.17%	2.95	15.87				
			RCP					115.00	1.00%	7.20	0.27				
			RCP					970.00	1.00%	8.36	1.93	28.23	4060.00	32.56	28.23
C2.1	0.45	2.18	20.0	52.00	2.00%	0.13	6.76	1450.00	1.58%	2.51	9.61	16.37	1502.00	18.34	16.37
C2.2	0.45	3.81	7.0	100.00	3.80%	0.22	7.58	195.00	3.80%	1.36	2.38				
			20.0					882.00	2.35%	3.07	4.79	14.76	1177.00	16.54	14.76
C2.3	0.45	4.79	20.0	100.00	4.00%	0.22	7.45	1065.00	2.23%	2.99	5.94	13.39	1165.00	16.47	13.39
DP-5	0.45	10.78	20.0	52.00	2.00%	0.13	6.76	1585.00	1.65%	2.57	10.28	17.04	1637.00	19.09	17.04
C2.4	0.45	2.86	20.0	32.00	3.13%	0.12	4.57	963.00	3.88%	3.94	4.07	8.65	995.00	15.53	8.65
DP-6	0.45	13.64	20.0	52.00	2.00%	0.13	6.76	1795.00	1.72%	2.62	11.41	18.16	1847.00	20.26	18.16

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
C2.5	0.45	6.42	7.0	54.00	8.33%	0.21	4.30	81.00	2.13%	1.02	1.32				
			20.0					1910.00	1.56%	2.50	12.74	18.36	2045.00	21.36	18.36
C2.6	0.45	0.43	20.0	36.00	2.00%	0.11	5.62	373.00	2.14%	2.93	2.12	7.75	409.00	12.27	7.75
C2.7	0.45	3.31	20.0	86.00	2.91%	0.19	7.68	946.00	3.85%	3.92	4.02	11.70	1032.00	15.73	11.70
DP-7	0.45	10.16	7.0	54.00	8.33%	0.21	4.30	81.00	2.13%	1.02	1.32				
			20.0					2294.00	1.64%	2.56	14.93	20.54	2429.00	23.49	20.54
DP-8	0.45	23.80	7.0	54.00	8.33%	0.21	4.30	81.00	2.13%	1.02	1.32				
			20.0					2294.00	1.64%	2.56	14.93				
			RCP					35.00	1.00%	10.46	0.06	20.60	2464.00	23.69	20.60
C2.8	0.45	1.78	20.0	34.00	2.00%	0.10	5.47	873.00	3.38%	3.68	3.96	9.42	907.00	15.04	9.42
C2.9	0.45	2.73	7.0	100.00	3.30%	0.21	7.94	107.00	3.40%	1.29	1.38				
			20.0					890.00	2.62%	3.24	4.58	13.90	1097.00	16.09	13.90
DP-9	0.45	4.51	7.0	100.00	3.30%	0.21	7.94	107.00	3.40%	1.29	1.38				
			20.0					890.00	2.62%	3.24	4.58	13.90	1097.00	16.09	13.90
C2.10	0.45	1.70	7.0	100.00	2.88%	0.20	8.31	56.00	2.88%	1.19	0.79				
			20.0					929.00	3.15%	3.55	4.36	13.45	1085.00	16.03	13.45
DP-10	0.45	6.21	7.0	100.00	3.30%	0.21	7.94	107.00	3.40%	1.29	1.38				
			20.0					890.00	2.62%	3.24	4.58				
			RCP					60.00	1.00%	7.20	0.14	14.04	1157.00	16.43	14.04
C2.11	0.24	6.29	20.0	79.00	6.33%	0.17	7.53	277.00	3.61%	3.80	1.21				
			20.0					60.00	31.67%	11.26	0.09				
			20.0					584.00	0.50%	1.41	6.88	15.71	1000.00	15.56	15.56
DP-11 (C2)	0.41	36.30	7.0	54.00	8.33%	0.20	4.56	81.00	2.13%	1.02	1.32				
			20.0					2294.00	1.64%	2.56	14.93				
			RCP					215.00	3.00%	19.80	0.18				
			20.0					535.00	0.50%	1.41	6.31	27.29	3179.00	27.66	27.29
C3.1	0.45	55.11	20.0	72.00	2.50%	0.16	7.39	2550.00	2.67%	3.27	13.00	20.39	2622.00	24.57	20.39
C4.1	0.45	4.61	7.0	52.00	11.54%	0.23	3.78	169.00	3.08%	1.23	2.29				
			20.0					1650.00	1.39%	2.36	11.66	17.74	1871.00	20.39	17.74
C4.2	0.45	3.66	20.0	41.00	2.00%	0.11	6.00	1079.00	4.37%	4.18	4.30	10.30	1120.00	16.22	10.30
DP-12	0.45	8.27	7.0	52.00	11.54%	0.23	3.78	169.00	3.08%	1.23	2.29				
			20.0					2637.00	2.62%	3.24	13.58	19.65	2858.00	25.88	19.65

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
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Job No: 100.061
Project: The Hills at Lorson Ranch

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed tc Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
C4.3	0.46	2.61	7.0	100.00	2.90%	0.20	8.16	80.00	2.90%	1.19	1.12				
			20.0					600.00	0.80%	1.79	5.59	14.87	780.00	14.33	14.33
C4.4	0.46	2.99	20.0	25.00	2.00%	0.09	4.61	1047.00	2.80%	3.35	5.21	9.83	1072.00	15.96	9.83
DP-13	0.45	13.87	7.0	52.00	11.54%	0.23	3.78	169.00	3.08%	1.23	2.29				
			20.0					2900.00	2.59%	3.22	15.02	21.09	3121.00	27.34	21.09
C4.5	0.90	0.63	20.0	56.00	3.93%	0.54	1.73	384.00	2.86%	3.38	1.89	3.62	440.00	12.44	3.62
DP-14	0.43	14.50	7.0	52.00	11.54%	0.22	3.90	169.00	3.08%	1.23	2.29				
			20.0					2900.00	2.62%	3.24	14.93				
			RCP					60.00	1.00%	8.36	0.12	21.24	3181.00	27.67	21.24
C4.6	0.32	3.69	7.0	100.00	6.42%	0.22	7.65	62.00	6.42%	1.77	0.58				
			7.0					51.00	31.77%	3.95	0.22				
			7.0					436.00	0.60%	0.54	13.40	21.85	649.00	13.61	13.61
DP-15 (C4)	0.43	18.19	7.0	54.00	8.33%	0.20	4.43	169.00	3.08%	1.23	2.29				
			20.0					2900.00	2.62%	3.24	14.93				
			RCP					160.00	1.00%	8.36	0.32				
			7.0					430.00	0.60%	0.54	13.22	35.19	3713.00	30.63	30.63
C5.1	0.46	25.14	7.0	42.00	2.38%	0.12	5.65	45.00	24.44%	3.46	0.22				
			15.0					123.00	2.44%	2.34	0.87				
			20.0					1647.00	4.49%	4.24	6.48				
			RCP					300.00	2.00%	9.89	0.51	13.72	2157.00	21.98	13.72
C5.2	0.49	1.71	20.0	38.00	2.63%	0.13	4.95	677.00	2.48%	3.15	3.58	8.53	715.00	13.97	8.53
C5.3	0.46	2.26	20.0	42.00	2.00%	0.12	5.98	1115.00	4.68%	4.33	4.30	10.28	1157.00	16.43	10.28
DP-16	0.46	3.97	20.0	42.00	2.00%	0.12	5.98	1115.00	4.68%	4.33	4.30	10.28	1157.00	16.43	10.28
C5.4	0.90	0.73	20.0	26.00	2.00%	0.29	1.47	578.00	2.37%	3.08	3.13	4.60	604.00	13.36	4.60
DP-17	0.54	4.70	7.0	100.00	3.23%	0.24	6.89	197.00	3.23%	1.26	2.61				
			RCP					53.00	1.00%	7.20	0.12	9.62	350.00	11.94	9.62
DP-18	0.47	25.14	7.0	42.00	2.38%	0.13	5.56	45.00	24.44%	3.46	0.22				
			15.0					123.00	2.44%	2.34	0.87				
			20.0					1647.00	4.49%	4.24	6.48				
			RCP					430.00	2.00%	13.34	0.54	13.66	2287.00	22.71	13.66
C5.5	0.49	2.27	20.0	43.00	2.00%	0.12	5.77	783.00	3.07%	3.50	3.72	9.49	826.00	14.59	9.49

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BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc $t_c=(L/180)+10$ minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
DP-19	0.47	25.14	7.0	42.00	2.38%	0.13	5.56	45.00	24.44%	3.46	0.22				
			15.0					123.00	2.44%	2.34	0.87				
			20.0					1647.00	4.49%	4.24	6.48				
			RCP					1237.00	2.00%	13.34	1.55	14.67	3094.00	27.19	14.67
C6.1	0.45	1.21	20.0	36.00	2.00%	0.11	5.62	9.28	2.60%	3.22	0.05	5.67	45.28	10.25	5.67
C6.2	0.45	4.35	20.0	60.00	3.00%	0.16	6.35	1312.00	0.93%	1.93	11.34	17.69	1372.00	17.62	17.62
DP-20	0.45	5.56	20.0	60.00	3.00%	0.16	6.35	1312.00	0.93%	1.93	11.34	17.69	1372.00	17.62	17.62
C6.3	0.45	0.56	20.0	43.00	2.00%	0.12	6.15	271.00	1.00%	2.00	2.26	8.40	314.00	11.74	8.40
DP-21	0.45	6.12	20.0	60.00	3.00%	0.16	6.35	1312.00	0.93%	1.93	11.34				
			RCP					63.00	1.00%	7.20	0.15	17.83	1435.00	17.97	17.83
C6.4	0.45	4.02	20.0	32.00	3.75%	0.12	4.31	1656.00	2.50%	3.16	8.73	13.03	1688.00	19.38	13.03
C6.5	0.47	0.33	20.0	43.00	2.00%	0.12	5.96	237.00	2.83%	3.36	1.17	7.13	280.00	11.56	7.13
DP-22	0.45	4.35	20.0	60.00	3.00%	0.16	6.35	1312.00	0.93%	1.93	11.34	17.69	1372.00	17.62	17.62
C6.6	0.90	1.44	20.0	67.00	2.84%	0.53	2.10	770.00	3.08%	3.51	3.66	5.76	837.00	14.65	5.76
DP-24	0.50	11.91	20.0	60.00	3.00%	0.17	5.86	1312.00	0.93%	1.93	11.34				
			RCP					63.00	1.00%	7.20	0.15				
			RCP					245.00	4.00%	14.40	0.28				
			RCP					50.00	4.50%	20.02	0.04	17.67	1730.00	19.61	17.67
C6.7	0.32	3.83	7.0	48.00	12.92%	0.19	4.20	132.00	4.92%	1.55	1.42				
			7.0					46.00	30.43%	3.86	0.20				
			7.0					209.00	0.60%	0.54	6.42	12.24	435.00	12.42	12.24
DP-25	0.46	15.74	20.0	60.00	3.00%	0.16	6.25	1312.00	0.93%	1.93	11.34				
			RCP					63.00	1.00%	7.20	0.15				
			RCP					245.00	4.00%	14.40	0.28				
			RCP					50.00	4.50%	20.02	0.04	18.06	1730.00	19.61	18.06
C7.1	0.49	2.35	20.0	58.00	2.60%	0.16	6.14	506.00	3.28%	3.62	2.33	8.47	564.00	13.13	8.47
C7.2	0.49	0.84	20.0	65.00	2.00%	0.15	7.09	536.00	2.48%	3.15	2.84	9.93	601.00	13.34	9.93
C7.3	0.49	1.99	20.0	34.00	2.00%	0.11	5.13	700.00	2.00%	2.83	4.12	9.25	734.00	14.08	9.25
DP-26	0.49	5.18	20.0	65.00	2.00%	0.15	7.09	536.00	2.48%	3.15	2.84	9.93	601.00	13.34	9.93
C7.4	0.49	2.71	7.0	100.00	2.40%	0.20	8.28	61.00	2.40%	1.08	0.94				
			20.0					642.00	1.36%	1.36	7.87	17.09	803.00	14.46	14.46

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley — Job No: 100.061
Date: April 17, 2020 — Project: The Hills at Lorson Ranch
Checked By: Leonard Beasley

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc $t_c=(L/180)+10$ minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
C7.5	0.49	0.50	20.0	32.00	2.00%	0.11	4.98	450.00	2.27%	3.01	2.49	7.46	482.00	12.68	7.46
DP-27	0.49	3.21	7.0	100.00	2.40%	0.20	8.28	61.00	2.40%	1.08	0.94				
			20.0					642.00	1.36%	1.36	7.87	17.09	803.00	14.46	14.46
DP-28	0.49	4.42	7.0	100.00	2.40%	0.20	8.28	61.00	2.40%	1.08	0.94				
			20.0					642.00	1.36%	1.36	7.87	17.09	803.00	14.46	14.46
C7.6	0.24	4.42	7.0	64.00	3.44%	0.13	8.29	16.00	31.25%	3.91	0.07				
			7.0					228.00	2.63%	1.14	3.35				
			7.0					49.00	32.65%	4.00	0.20				
			7.0					208.00	0.80%	0.63	5.54	17.45	565.00	13.14	13.14
DP-29	0.40	12.81	7.0	100.00	2.40%	0.18	9.50	61.00	2.40%	1.08	0.94				
			20.0					642.00	1.36%	2.33	4.59				
			RCP					140.00	12.00%	24.94	0.09				
			20.0					225.00	0.80%	1.79	2.10	17.22	1168.00	16.49	16.49
C8.1	0.46	8.11	20.0	45.00	2.00%	0.12	6.19	1670.00	3.96%	3.98	6.99	13.18	1715.00	19.53	13.18
C8.2	0.49	2.12	20.0	50.00	4.20%	0.17	4.87	385.00	0.64%	1.60	4.01	8.88	435.00	12.42	8.88
C4.1-ex	0.10	4.39	7.0	300.00	4.50%	0.26	19.10	143.00	4.60%	1.50	1.59	20.68	443.00	12.46	20.68
C8.3	0.47	16.38	7.0	50.00	23.20%	0.29	2.85	115.00	2.09%	1.01	1.89				
			20.0					1900.00	3.52%	1.36	23.28	28.03	2065.00	21.47	21.47
DP-30	0.39	20.77	7.0	50.00	23.20%	0.26	3.22	115.00	2.09%	1.01	1.89				
			20.0					1900.00	3.52%	1.36	23.28	28.39	2065.00	21.47	21.47
DP-31	0.41	31.00	7.0	50.00	23.20%	0.27	3.13	115.00	2.09%	1.01	1.89				
			20.0					2350.00	3.03%	3.48	11.25	16.27	2515.00	23.97	23.97
C8.4	0.46	6.70	20.0	25.00	5.20%	0.12	3.36	1343.00	3.88%	3.94	5.68	9.04	1368.00	17.60	9.04
DP-32	0.47	37.70	7.0	50.00	23.20%	0.29	2.85	115.00	2.09%	1.01	1.89				
			20.0					2350.00	3.03%	1.36	28.80	33.55	2515.00	23.97	23.97
C8.5	0.49	3.49	20.0	12.00	2.00%	0.07	3.05	1225.00	3.25%	3.61	5.66	8.71	1237.00	16.87	8.71
C8.6	0.90	0.79	20.0	25.00	2.80%	0.32	1.29	730.00	2.30%	3.03	4.01	5.30	755.00	14.19	5.30
DP-33	0.57	4.28	20.0	12.00	2.00%	0.08	2.64	1980.00	2.87%	3.39	9.74	12.38	1992.00	21.07	21.07
C8.7	0.48	23.61	7.0	20.00	18.50%	0.17	1.91	99.00	2.42%	1.09	1.52				
			20.0					2654.00	2.15%	1.36	32.52	35.95	2773.00	25.41	25.41
DP-34	0.48	27.89	7.0	20.00	18.50%	0.17	1.91	99.00	2.42%	1.09	1.52				
			20.0					2654.00	2.15%	1.36	32.52	35.95	2773.00	25.41	25.41

Standard Form SF-1. Time of Concentration-Proposed

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional t_c t_c=(L/180)+10 minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
C8.8	0.22	7.80	7.0	100.00	2.00%	0.13	12.69	611.00	5.48%	1.64	6.21				
			7.0					53.00	33.00%	4.02	0.22				
			7.0					245.00	0.60%	0.54	7.53	26.65	1009.00	15.61	15.61
DP-35	0.43	73.39	7.0	20.00	18.50%	0.16	2.07	99.00	2.42%	1.09	1.52				
			20.0					2654.00	2.15%	2.93	15.08				
			RCP					566.00	5.30%	21.72	0.43				
			7.0					272.00	0.60%	0.54	8.36	27.46	3611.00	30.06	27.46
C10.1	0.49	2.65	20.0	28.00	3.60%	0.12	3.82	590.00	2.37%	3.08	3.19	7.01	618.00	13.43	7.01
C10.2	0.49	0.50	20.0	28.00	3.57%	0.12	3.83	334.00	0.84%	1.83	3.04	6.87	362.00	12.01	6.87
C10.3	0.49	0.26	20.0	33.00	3.00%	0.12	4.40	220.00	0.60%	1.55	2.37	6.77	253.00	11.41	6.77
DP-36	0.49	3.41	20.0	28.00	3.60%	0.12	3.82	868.00	1.92%	2.77	5.22	9.04	896.00	14.98	9.04
C10.4	0.49	2.64	20.0	76.00	2.12%	0.17	7.49	550.00	2.04%	2.86	3.21	10.70	626.00	13.48	10.70
DP-37	0.49	6.05	20.0	76.00	2.12%	0.17	7.49	550.00	2.04%	2.86	3.21				
			RCP					40.00	1.46%	11.41	0.06	10.76	666.00	13.70	10.76
C10.5	0.48	0.90	7.0	100.00	3.20%	0.22	7.65	30.00	3.30%	1.27	0.39				
			20.0					353.00	2.15%	2.93	2.01	10.05	483.00	12.68	10.05
C10.6	0.49	0.56	20.0	16.00	2.00%	0.08	3.50	490.00	2.51%	3.17	2.58	6.08	506.00	12.81	6.08
C5.1-ex	0.11	4.81	7.0	300.00	4.80%	0.27	18.51	285.00	4.80%	1.53	3.10	21.60	585.00	13.25	21.60
C10.7	0.45	3.36	7.0	100.00	2.00%	0.18	9.37	72.00	2.78%	1.17	1.03				
			20.0					807.00	4.56%	4.27	3.15				
			20.0					315.00	0.60%	1.55	3.39	16.94	1294.00	17.19	16.94
DP-38	0.25	8.17	7.0	100.00	2.00%	0.14	12.26	72.00	2.78%	1.17	1.03				
			20.0					807.00	4.56%	4.27	3.15				
			20.0					315.00	0.60%	1.55	3.39	19.82	1294.00	17.19	17.19
C10.8	0.45	1.89	7.0	100.00	3.23%	0.21	8.00	197.00	3.23%	1.26	2.61				
			20.0					59.00	0.60%	1.55	0.63	11.24	356.00	11.98	11.24
DP-39	0.29	8.17	7.0	100.00	2.00%	0.14	11.68	72.00	2.78%	1.17	1.03				
			20.0					807.00	4.56%	4.27	3.15				
			20.0					922.00	0.60%	1.55	9.92	25.78	1901.00	20.56	20.56
C10.9	0.46	3.73	7.0	100.00	5.00%	0.24	6.81	932.00	4.61%	1.50	10.34	17.15	1032.00	15.73	15.73
C10.10	0.45	6.86	20.0	100.00	3.00%	0.20	8.20	1141.00	3.68%	3.84	4.96	13.15	1241.00	16.89	13.15
DP-40	0.34	10.06	7.0	100.00	2.00%	0.15	10.96	72.00	2.78%	1.17	1.03				
			20.0					807.00	4.56%	4.27	3.15				
			20.0					1027.00	0.60%	1.55	11.05	26.19	2006.00	21.14	21.14

Standard Form SF-1. Time of Concentration-Proposed

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc $t_c=(L/180)+10$ minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
C10.11	0.22	9.10	7.0	77.00	2.20%	0.12	10.79	12.00	33.33%	4.04	0.05				
			7.0					102.00	2.94%	1.20	1.42				
			7.0					45.00	33.33%	4.04	0.19				
			7.0					468.00	0.66%	0.57	13.72	26.16	704.00	13.91	13.91
C10	0.34	37.26	7.0	100.00	2.00%	0.15	10.96	72.00	2.78%	1.17	1.03				
			20.0					807.00	4.56%	4.27	3.15				
			20.0					1027.00	0.60%	1.55	11.05				
			RCP					385.00	1.00%	9.44	0.68	26.86	2391.00	23.28	23.28
C12.1 **(DP-41)**	0.48	1.23	20.0	70.00	2.00%	0.16	7.48	355.00	0.94%	1.94	3.05	10.53	425.00	12.36	10.53
C12.2	0.49	2.69	7.0	100.00	2.38%	0.20	8.30	72.00	2.38%	1.08	1.11				
			20.0					401.00	1.32%	2.30	2.91	12.32	573.00	13.18	12.32
C12.3	0.49	0.76	20.0	56.00	2.14%	0.15	6.44	437.00	1.56%	2.50	2.92	9.35	493.00	12.74	9.35
DP-42	0.49	3.45	7.0	100.00	2.38%	0.20	8.30	72.00	2.38%	1.08	1.11				
			20.0					461.00	1.28%	2.26	3.40	12.81	633.00	13.52	12.81
C12.4	0.49	1.58	7.0	100.00	2.20%	0.20	8.52	51.00	2.20%	1.04	0.82				
			20.0					335.00	1.71%	2.62	2.13	11.48	486.00	12.70	11.48
C12.5	0.49	2.60	7.0	100.00	2.00%	0.19	8.80	12.00	2.00%	0.99	0.20				
			20.0					1094.00	1.12%	2.12	8.61	17.61	1206.00	16.70	16.70
DP-43	0.49	2.60	7.0	100.00	2.00%	0.19	8.80	12.00	2.00%	0.99	0.20				
			20.0					1094.00	1.12%	2.12	8.61	17.61	1206.00	16.70	16.70
C12.6	0.47	1.85	20.0	26.00	2.00%	0.09	4.63	491.00	1.78%	2.67	3.07	7.70	517.00	12.87	7.70
C12.7	0.45	2.09	7.0	100.00	2.00%	0.18	9.37	68.00	2.00%	0.99	1.14				
			20.0					438.00	1.88%	2.74	2.66	13.18	606.00	13.37	13.18
C12.8	0.76	0.54	20.0	21.00	3.79%	0.19	1.82	331.00	4.05%	4.02	1.37	3.19	352.00	11.96	3.19
DP-44	0.45	4.48	7.0	100.00	2.00%	0.18	9.37	68.00	2.00%	0.99	1.14				
			20.0					438.00	1.88%	2.74	2.66	13.18	606.00	13.37	13.18
DP-45	0.49	13.34	7.0	100.00	2.00%	0.19	8.80	12.00	2.00%	0.99	0.20				
			20.0					1094.00	1.12%	2.12	8.61	17.61	1206.00	16.70	16.70
C12.9	0.49	0.47	7.0	100.00	3.15%	0.22	7.57	5.00	3.15%	1.24	0.07				
			20.0					108.00	2.22%	2.98	0.60	8.24	213.00	11.18	8.24
C12.10	0.49	0.87	7.0	60.00	3.33%	0.17	5.76	26.00	16.92%	2.88	0.15				
			7.0					21.00	2.00%	0.99	0.35				
			20.0					190.00	2.22%	2.98	1.06	7.32	297.00	11.65	7.32

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
Date: April 17, 2020
Checked By: Leonard Beasley

Job No: 100.061
Project: The Hills at Lorson Ranch

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc $t_c=(L/180)+10$ minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
DP-46	0.49	1.34	7.0	100.00	3.15%	0.22	7.57	5.00	3.15%	1.24	0.07				
			20.0					298.00	2.22%	2.98	1.67	9.30	403.00	12.24	9.30
C12.11	0.49	0.86	7.0	97.00	2.33%	0.20	8.24	0.00	0.00%	0.00	0.00	8.24	97.00	10.54	8.24
D1.1	0.45	2.33	7.0	25.00	25.20%	0.21	2.03	133.00	3.01%	1.21	1.83				
			20.0					410.00	0.88%	1.88	3.64	7.49	568.00	13.16	7.49
D1.2	0.45	3.44	7.0	100.00	3.80%	0.22	7.58	27.00	3.70%	1.35	0.33				
			20.0					671.00	1.68%	2.59	4.31	12.23	798.00	14.43	12.23
D1.3	0.75	0.88	20.0	31.00	2.00%	0.18	2.81	800.00	3.68%	3.84	3.48	6.29	831.00	14.62	6.29
D1.4	0.45	1.92	20.0	50.00	2.00%	0.13	6.63	887.00	3.17%	3.56	4.15	10.78	937.00	15.21	10.78
DP-47	0.45	8.57	7.0	100.00	3.80%	0.22	7.58	27.00	3.70%	1.35	0.33				
			20.0					671.00	1.68%	2.59	4.31				
			RCP					55.00	1.00%	7.20	0.13	12.35	853.00	14.74	12.35
D1.5	0.21	3.25	7.0	100.00	11.00%	0.23	7.30	243.00	2.00%	0.99	4.09				
			20.0					334.00	3.14%	3.54	1.57	12.96	677.00	13.76	12.96
D1.6	0.09	2.67	7.0	100.00	4.20%	0.15	11.39	139.00	4.50%	1.48	1.56				
			20.0					512.00	2.83%	3.36	2.54	15.49	751.00	14.17	14.17

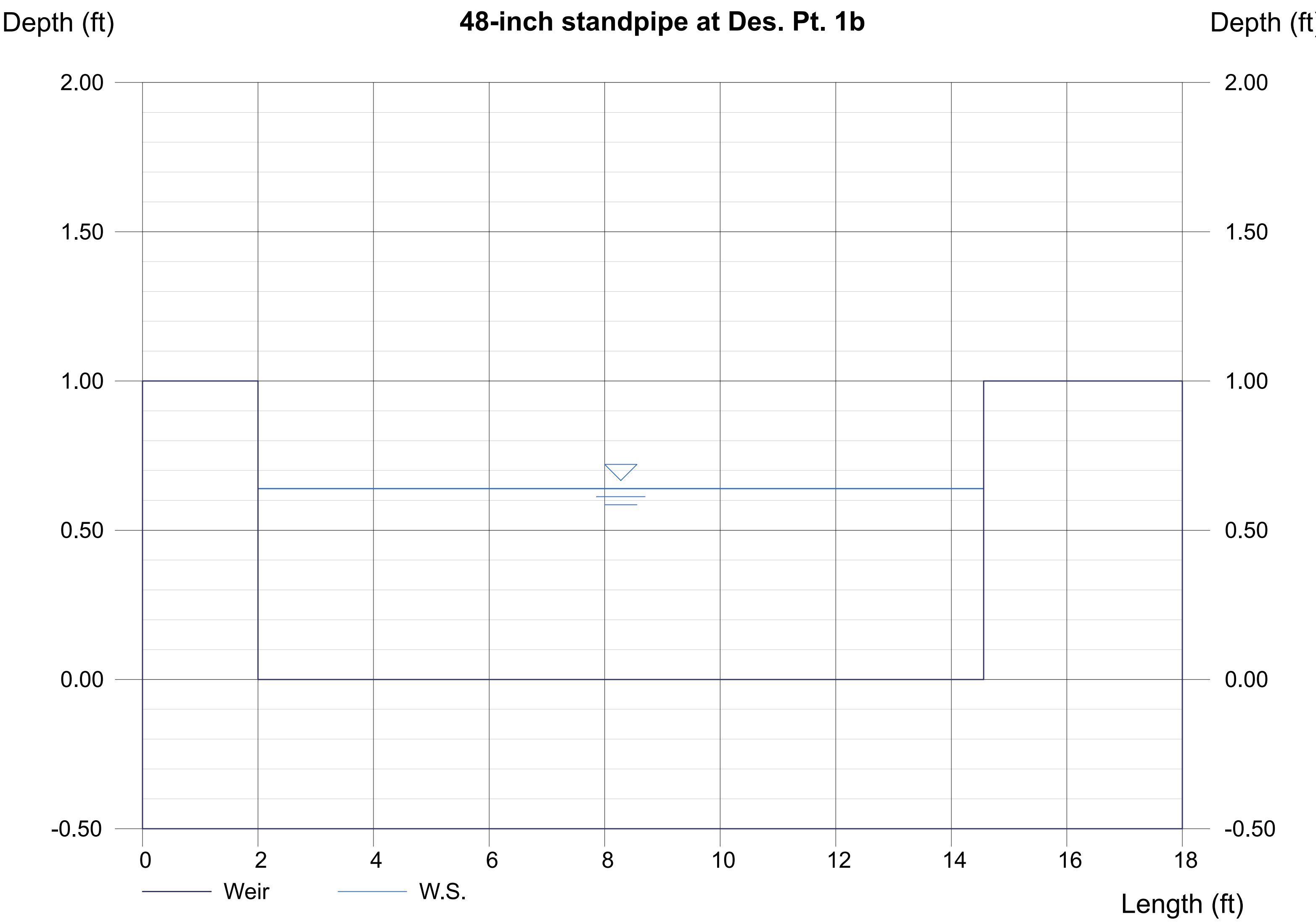
APPENDIX C – HYDRAULIC CALCULATIONS

Weir Report

48-inch standpipe at Des. Pt. 1b

Rectangular Weir	
Crest	= Sharp
Bottom Length (ft)	= 12.56
Total Depth (ft)	= 1.00
Calculations	
Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 21.40

Highlighted	
Depth (ft)	= 0.64
Q (cfs)	= 21.40
Area (sqft)	= 8.03
Velocity (ft/s)	= 2.66
Top Width (ft)	= 12.56



Weir Report

Hydraflow Express by Intelisolve — Wednesday, May 6 2020, 4:50 PM

48-INCH Standpipe at Design Pt. 13b

Rectangular Weir

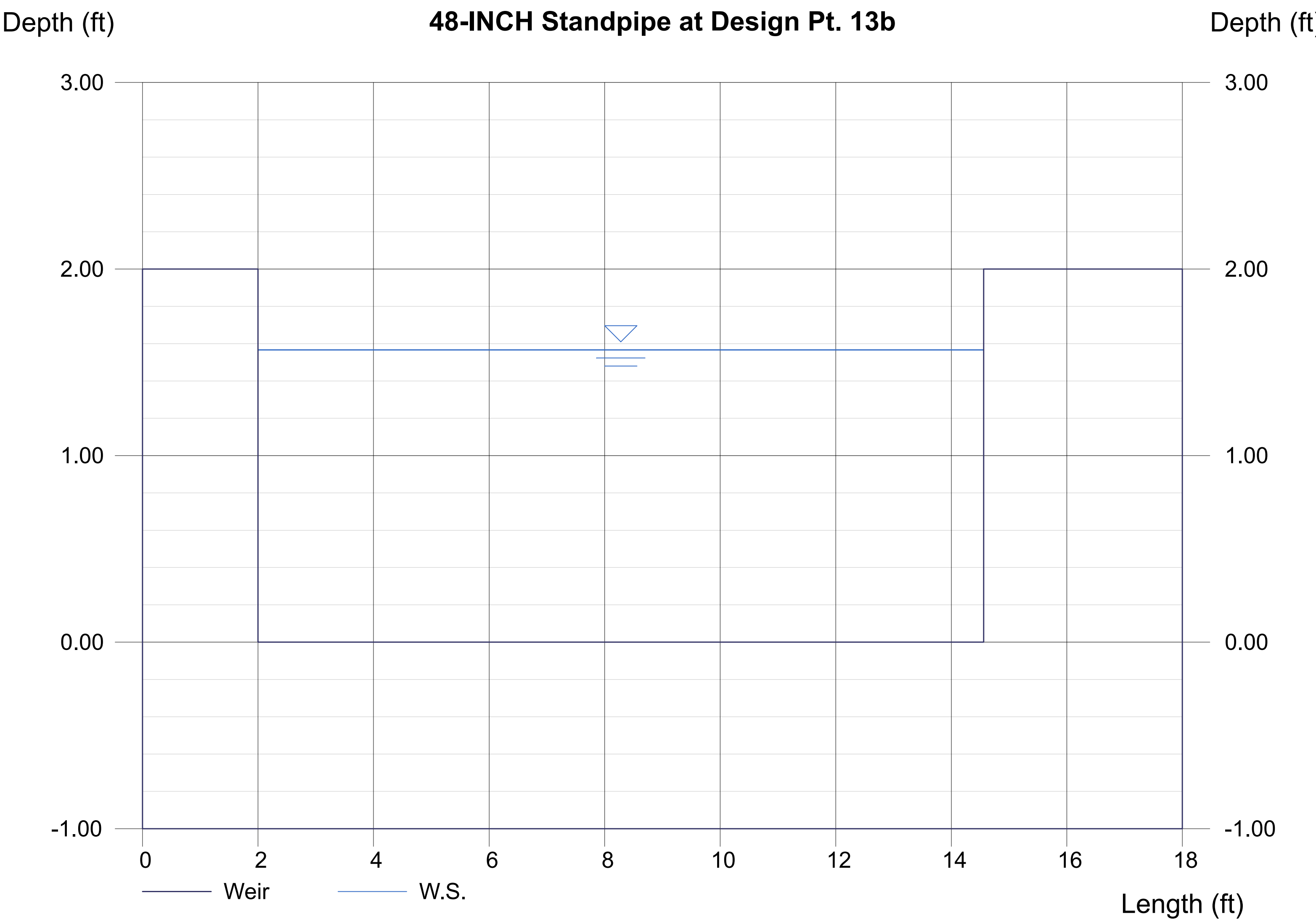
Crest	= Sharp
Bottom Length (ft)	= 12.56
Total Depth (ft)	= 2.00

Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 82.00

Highlighted

Depth (ft)	= 1.57
Q (cfs)	= 82.00
Area (sqft)	= 19.68
Velocity (ft/s)	= 4.17
Top Width (ft)	= 12.56



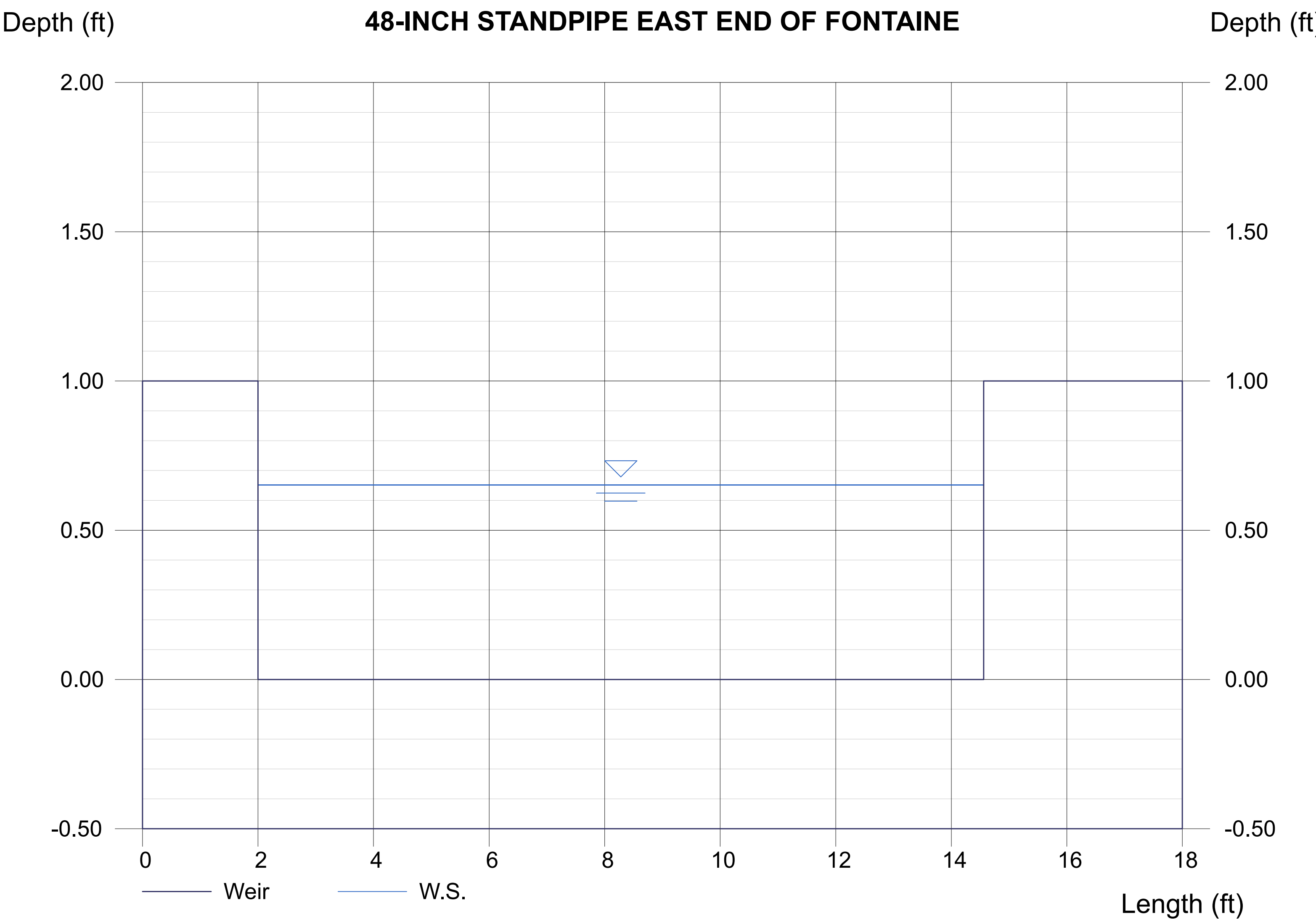
Weir Report

48-INCH STANDPIPE EAST END OF FONTAINE

Rectangular Weir
Crest = Sharp
Bottom Length (ft) = 12.56
Total Depth (ft) = 1.00

Calculations
Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 22.00

Highlighted
Depth (ft) = 0.65
Q (cfs) = 22.00
Area (sqft) = 8.18
Velocity (ft/s) = 2.69
Top Width (ft) = 12.56



Channel Report

Hydraflow Express by Intelisolve | Wednesday, Jul 22 2020, 8:22 AM

Diversion Swale C4.2-ex

Trapezoidal

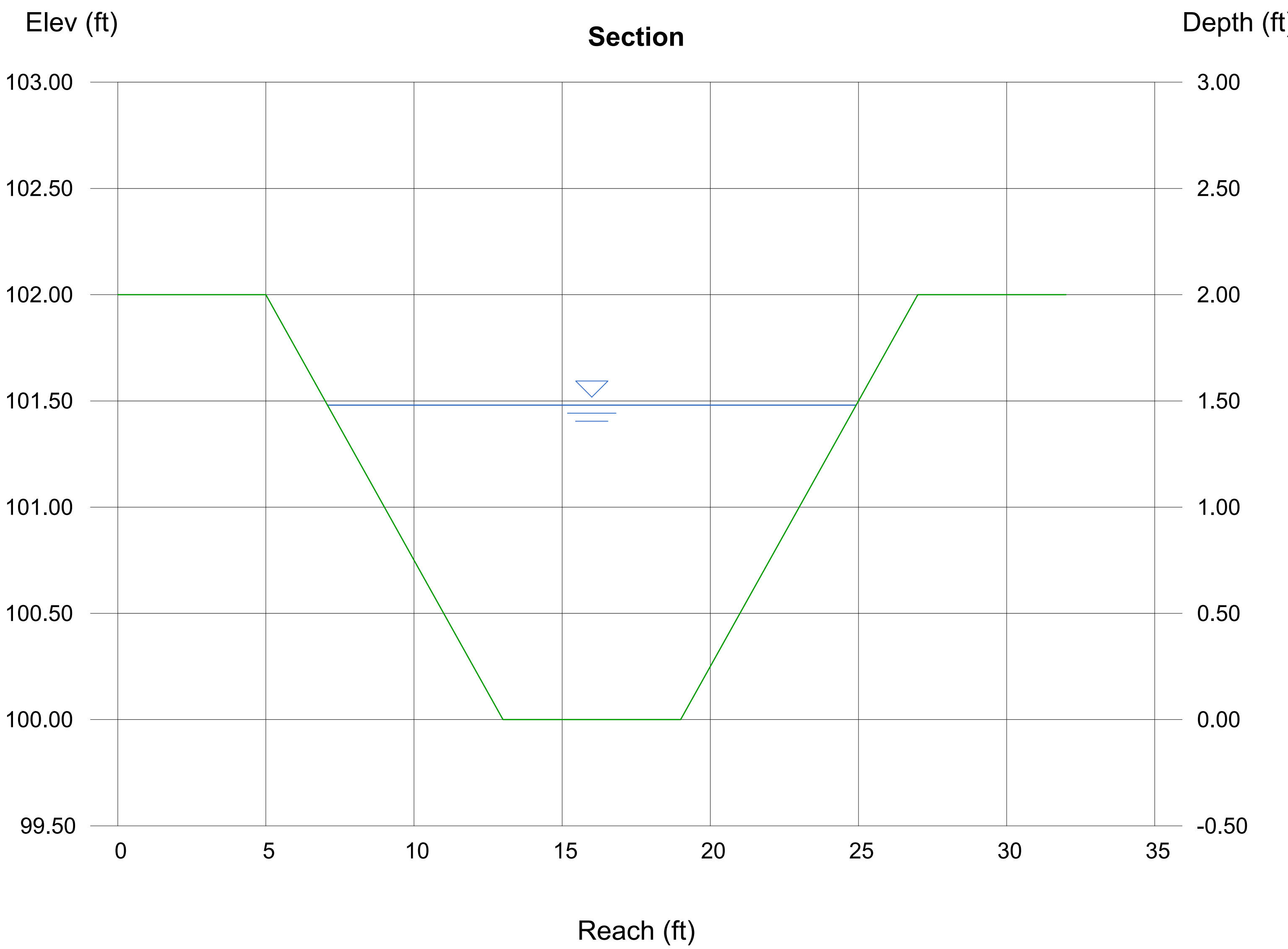
Botom Width (ft)	= 6.00
Side Slope (z:1)	= 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.70
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cfs)	= 85.10

Highlighted

Depth (ft)	= 1.48
Q (cfs)	= 85.10
Area (sqft)	= 17.64
Velocity (ft/s)	= 4.82
Wetted Perim (ft)	= 18.20
Crit Depth, Yc (ft)	= 1.37
Top Width (ft)	= 17.84
EGL (ft)	= 1.84



Weir Report

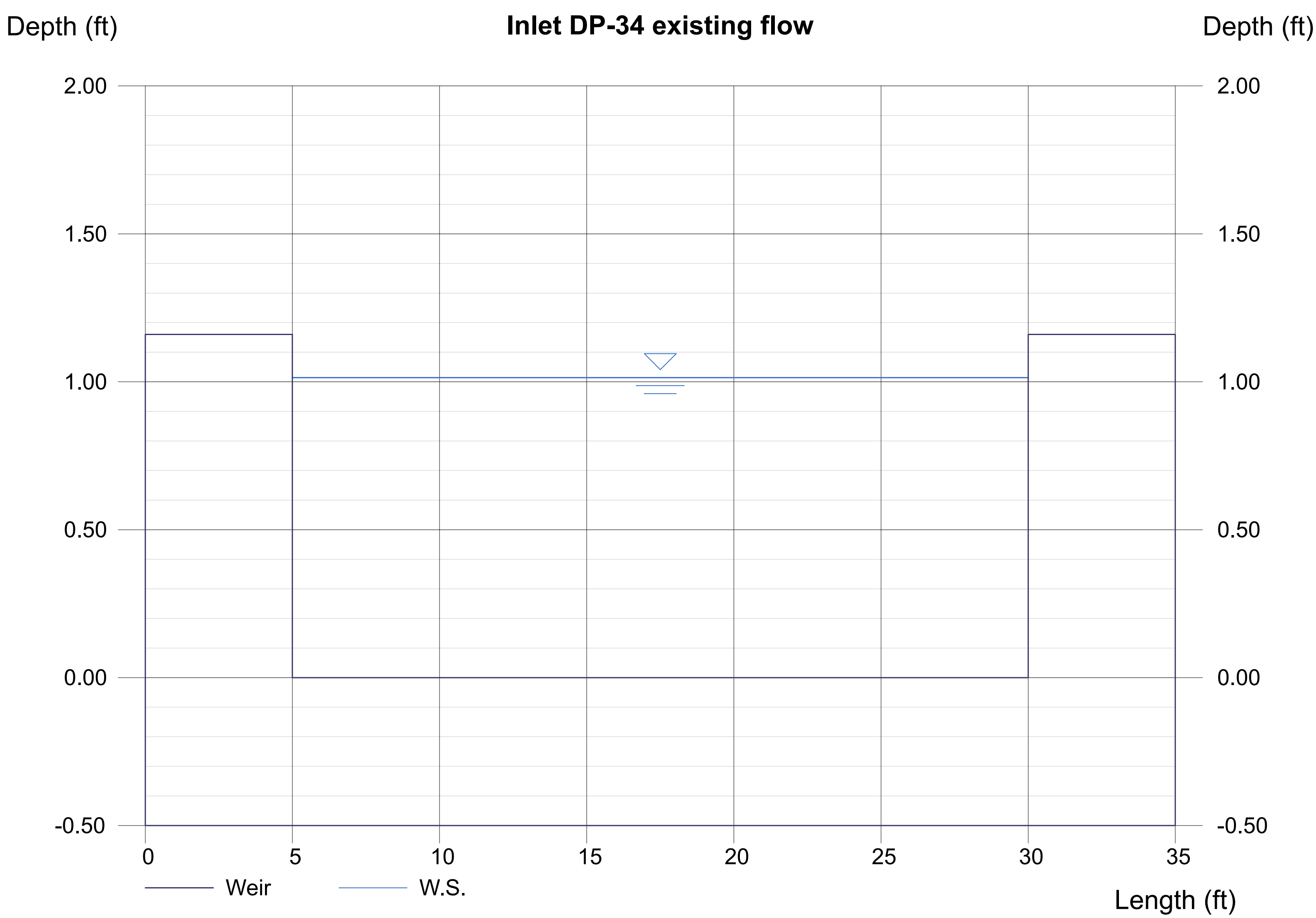
Hydraflow Express by Intelisolve | Tuesday, Oct 20 2020, 9:14 AM

Inlet DP-34 existing flow

Rectangular Weir
Crest = Sharp
Bottom Length (ft) = 25.00
Total Depth (ft) = 1.16

Calculations
Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 85.00

Highlighted
Depth (ft) = 1.01
Q (cfs) = 85.00
Area (sqft) = 25.35
Velocity (ft/s) = 3.35
Top Width (ft) = 25.00



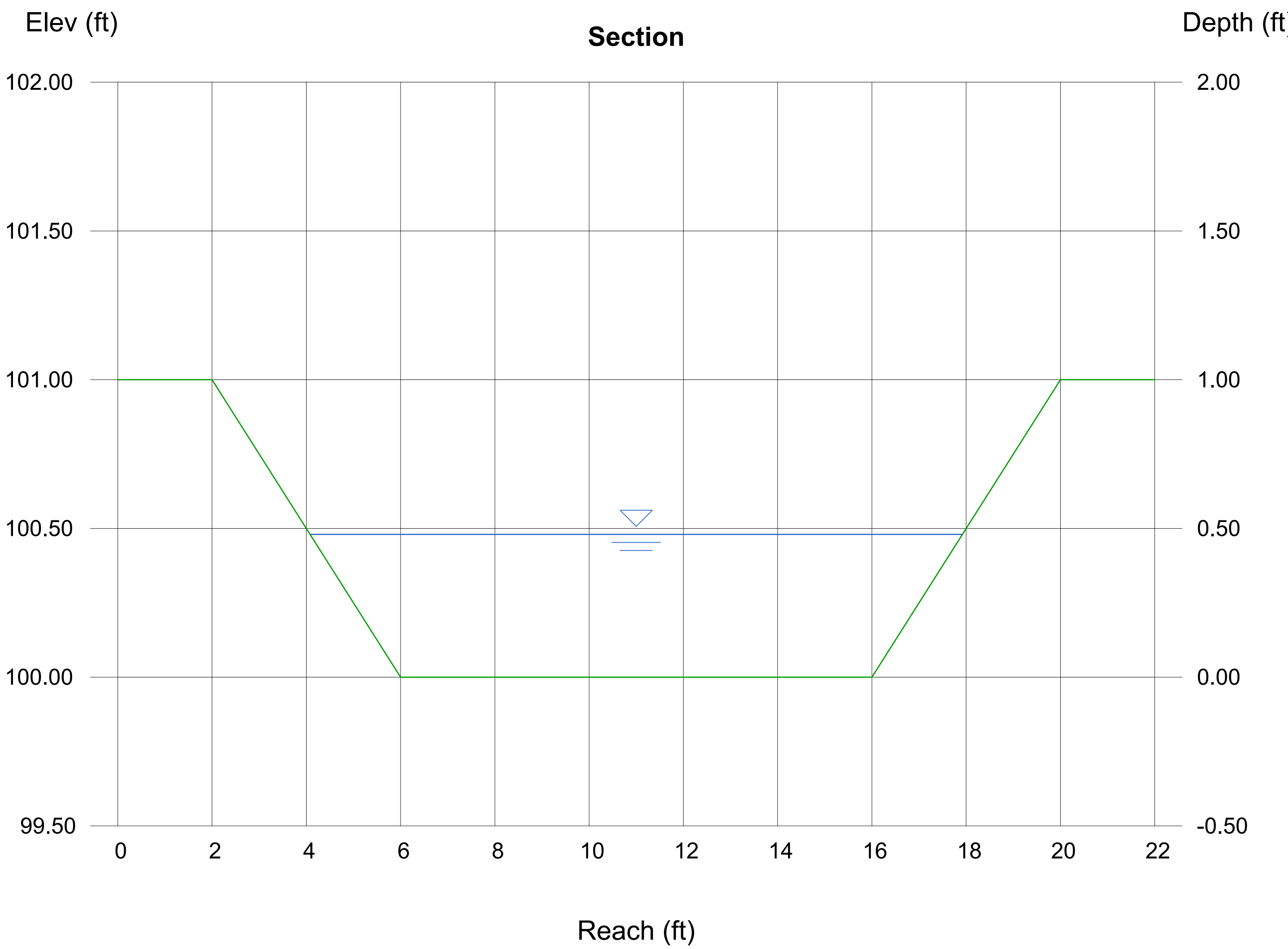
Channel Report

Overflow Swale #1

Trapezoidal
Botom Width (ft) = 10.00
Side Slope (z:1) = 4.00
Total Depth (ft) = 1.00
Invert Elev (ft) = 100.00
Slope (%) = 1.40
N-Value = 0.020

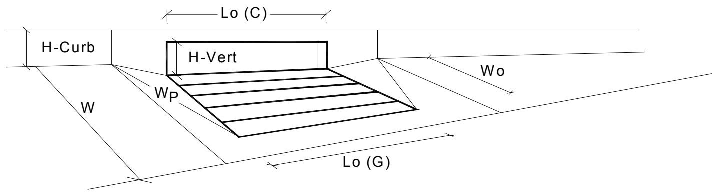
Calculations
Compute by: Known Q
Known Q (cfs) = 27.50

Highlighted
Depth (ft) = 0.48
Q (cfs) = 27.50
Area (sqft) = 5.72
Velocity (ft/s) = 4.81
Wetted Perim (ft) = 13.96
Crit Depth, Yc (ft) = 0.57
Top Width (ft) = 13.84
EGL (ft) = 0.84



INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



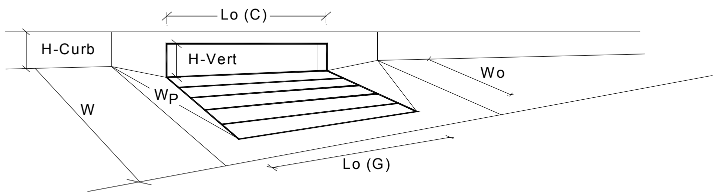
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.5	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.29	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.52	0.75	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.75	0.89	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**7.6**	**20.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	4.8	20.3	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



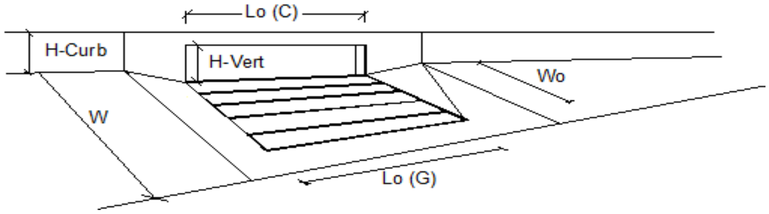
		MINOR	MAJOR	
Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.5	8.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.29	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**4.4**	**9.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.3	3.0	cfs

INLET ON A CONTINUOUS GRADE

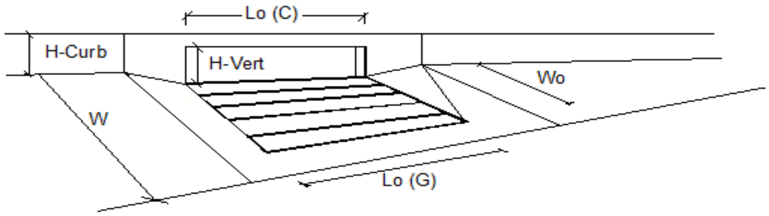
Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.4**	**3.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.9**	**3.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**72**	**48**	**%**

INLET ON A CONTINUOUS GRADE

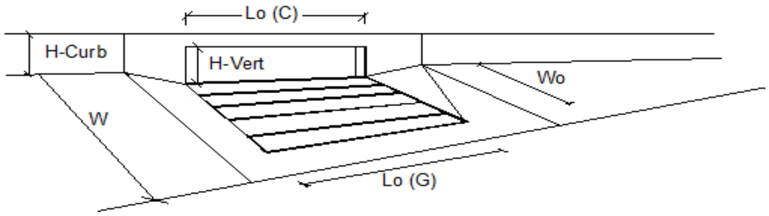
Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**3.9**	**5.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**5.4**	**15.2**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**41**	**26**	**%**

INLET ON A CONTINUOUS GRADE

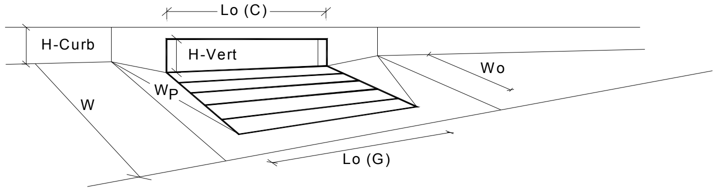
Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**5.4**	**8.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.7**	**5.0**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**89**	**63**	**%**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	7.8	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	30.00	30.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**14.8**	**35.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	14.3	34.8	cfs

INLET IN A SUMP OR SAG LOCATION

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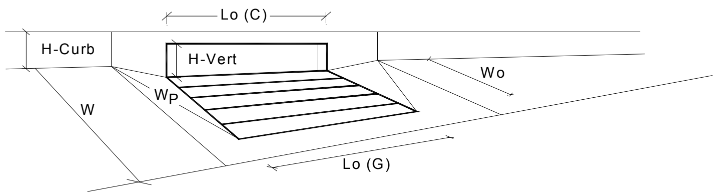

			MINOR	MAJOR	
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	7.8	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.30	0.49	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.53	0.74	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.76	0.89	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**12.5**	**30.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	12.1	29.9	cfs

INLET IN A SUMP OR SAG LOCATION

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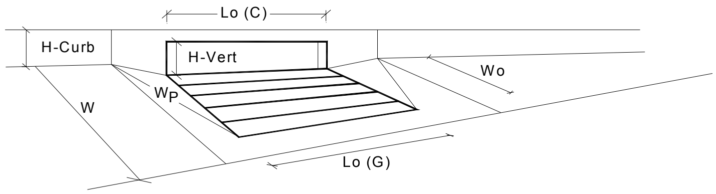

Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	7.8	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**8.0**	**19.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.9	17.2	cfs

INLET IN A SUMP OR SAG LOCATION

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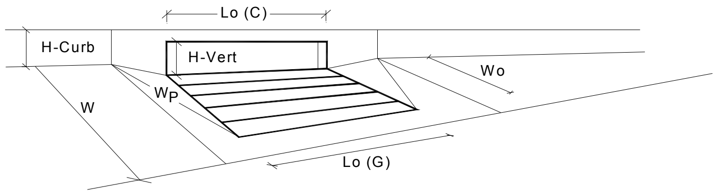

Design Information (Input)		MINOR	MAJOR	
Type of Inlet: CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	7.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.42	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.66	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.91	0.99	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**6.9**	**12.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.8	6.2	cfs

INLET IN A SUMP OR SAG LOCATION

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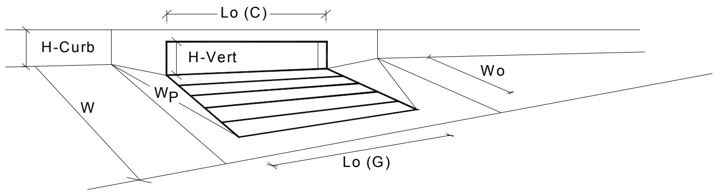

Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	7.8	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.30	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.53	0.74	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.76	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**12.5**	**29.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	11.2	24.5	cfs

INLET IN A SUMP OR SAG LOCATION

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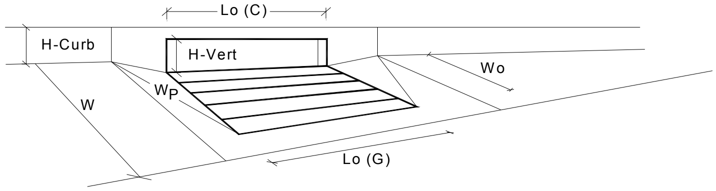

		MINOR	MAJOR	
Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	5.6	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.91	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**6.9**	**6.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.9	5.2	cfs

INLET IN A SUMP OR SAG LOCATION

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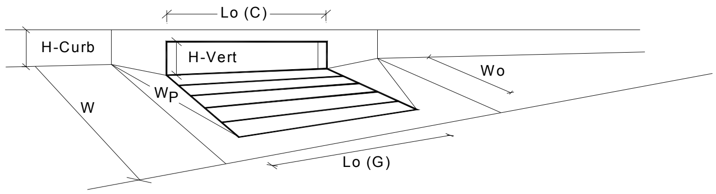

		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	7.8	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**8.0**	**19.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.9	17.7	cfs

INLET IN A SUMP OR SAG LOCATION

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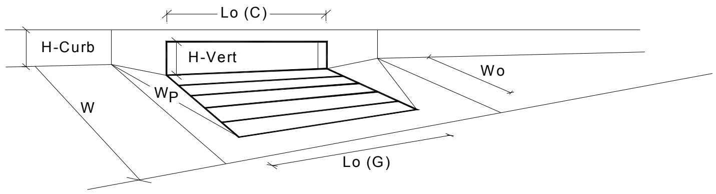


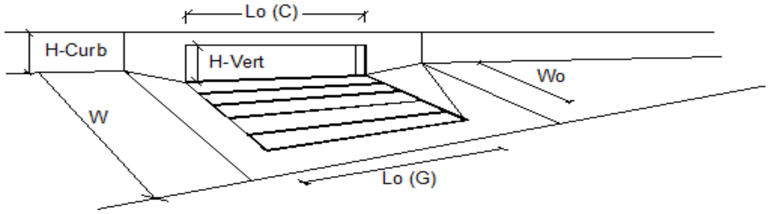
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	5.6	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.91	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**6.9**	**6.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.4	6.1	cfs

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.7**	**9.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**93**	**%**

INLET IN A SUMP OR SAG LOCATION

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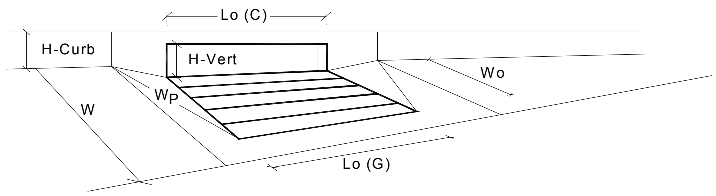

			MINOR	MAJOR	
Design Information (Input)	CDOT Type R Curb Opening				
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	7.8	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	20.00	20.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.30	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.53	0.74	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.76	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**10.3**	**24.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	9.1	20.1	cfs

INLET IN A SUMP OR SAG LOCATION

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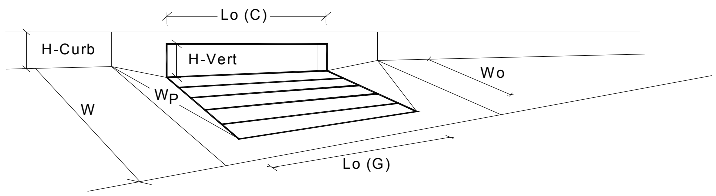

Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	5.6	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.72	0.72	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**4.6**	**4.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.1	2.4	cfs

INLET IN A SUMP OR SAG LOCATION

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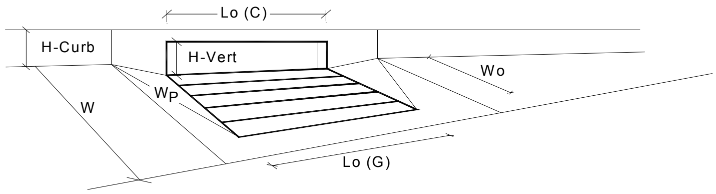


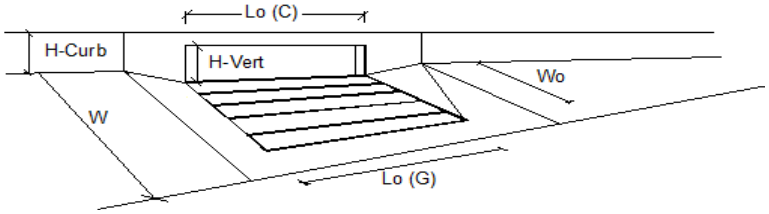
Design Information (Input)		MINOR	MAJOR	
Type of Inlet: CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.8	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**9.7**	**19.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.5	16.2	cfs

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.4**	**10.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**90**	**%**

Type of Inlet: CDOT Type R Curb Opening

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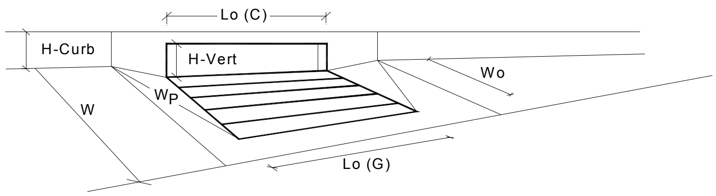

		MINOR	MAJOR	
Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.7	7.7	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	20.00	20.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.31	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.54	0.73	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.77	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**10.8**	**24.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	10.8	24.0	cfs

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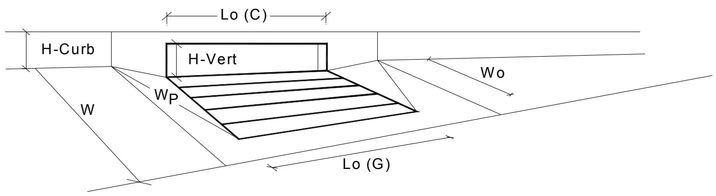

Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	7.1	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.27	0.42	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.49	0.67	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.88	0.99	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**5.6**	**12.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.6	12.5	cfs

INLET IN A SUMP OR SAG LOCATION

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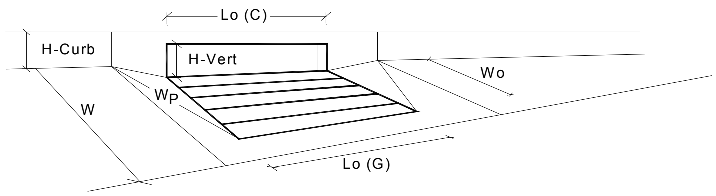

Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.9	7.8	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.49	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.56	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.78	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**14.5**	**30.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	14.5	30.0	cfs

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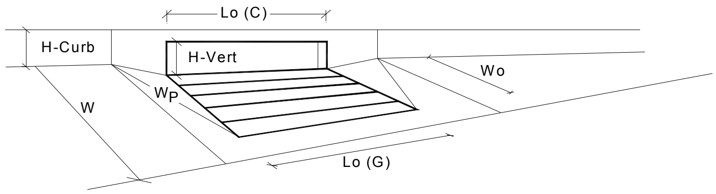

		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.4	7.7	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.28	0.47	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.51	0.72	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.75	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**7.2**	**18.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.2	18.2	cfs

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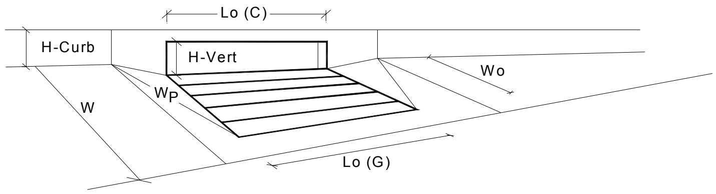

Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.9	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.76	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**5.2**	**9.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	5.2	11.6	cfs

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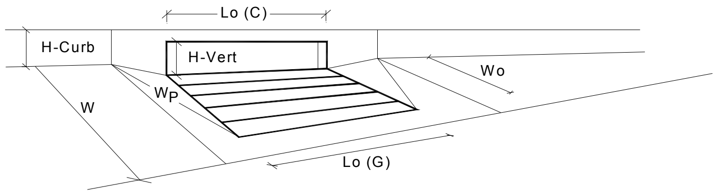

Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.9	8.4	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.56	0.79	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.78	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**14.7**	**35.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms	$Q_{PEAK\ REQUIRED}$ =	14.7	38.5	cfs

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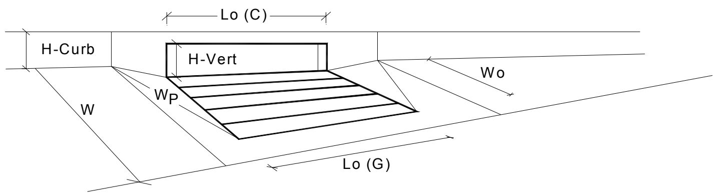

		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet: CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.7	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.40	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	0.86	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**5.4**	**6.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.8	6.9	cfs

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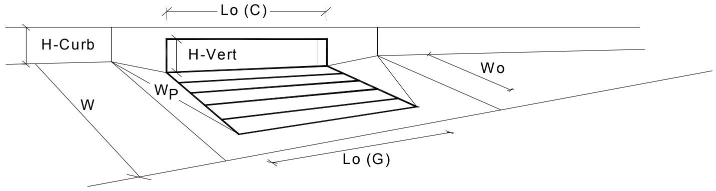

Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.4	6.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.20	0.34	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.56	0.77	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**2.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.4	5.4	cfs

INLET ON A CONTINUOUS GRADE

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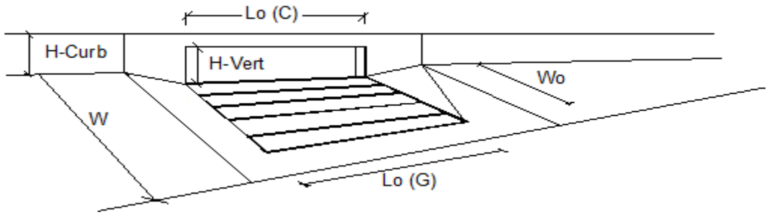
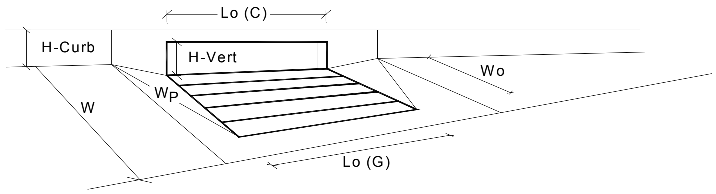


			MINOR	MAJOR	
Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**6.4**	**11.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**82**	**%**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	0.57	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	0.93	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**8.2**	**8.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	8.2	17.7	cfs

INLET ON A CONTINUOUS GRADE

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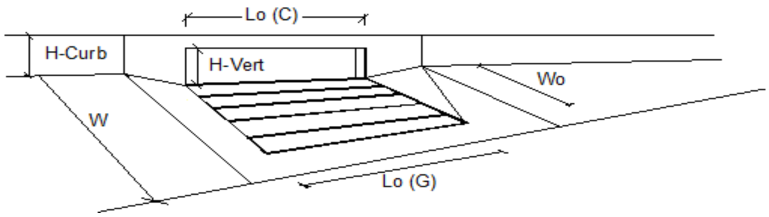

		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Inlet Management*)	**Q_o =**	**8.0**	**30.6**	cfs
Water Spread Width	T =	14.0	20.0	ft
Water Depth at Flowline (outside of local depression)	d =	4.9	7.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.9	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.426	0.249	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	4.6	22.6	cfs
Discharge within the Gutter Section W	Q_w =	3.4	7.5	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.6	cfs
Flow Area within the Gutter Section W	A_W =	0.64	1.04	sq ft
Velocity within the Gutter Section W	V_W =	5.3	7.2	fps
Water Depth for Design Condition	d_{LOCAL} =	7.9	10.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.100	0.067	ft/ft
Required Length L_T to Have 100% Interception	L_T =	15.90	37.60	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	15.00	15.00	ft
Interception Capacity	Q_i =	8.0	18.0	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	13.03	13.03	ft
Actual Interception Capacity	**Q_a =**	**7.9**	**17.5**	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.1**	**13.1**	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.9**	**17.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**13.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**57**	**%**

INLET ON A CONTINUOUS GRADE

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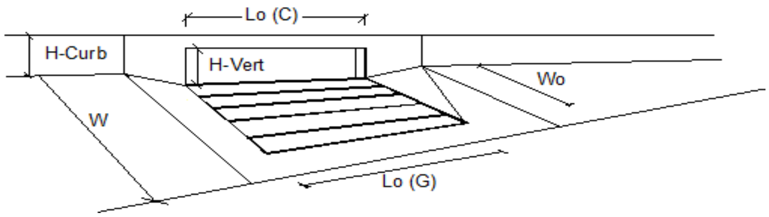

			MINOR	MAJOR	
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Inlet Management*)		Q_o =	**3.2**	**6.0**	cfs
Water Spread Width		T =	7.5	10.2	ft
Water Depth at Flowline (outside of local depression)		d =	3.3	4.0	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.722	0.571	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.9	2.6	cfs
Discharge within the Gutter Section W		Q_w =	2.3	3.4	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.38	0.49	sq ft
Velocity within the Gutter Section W		V_W =	6.0	7.0	fps
Water Depth for Design Condition		d_{LOCAL} =	6.3	7.0	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		Q_a =	**N/A**	**N/A**	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		Q_b =	**N/A**	**N/A**	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)		S_e =	0.156	0.127	ft/ft
Required Length L_T to Have 100% Interception		L_T =	8.57	12.95	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	8.57	10.00	ft
Interception Capacity		Q_i =	3.2	5.6	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.06	0.06	
Effective (Unclogged) Length		L_e =	8.75	8.75	ft
Actual Interception Capacity		Q_a =	**3.2**	**5.4**	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		Q_b =	**0.0**	**0.6**	cfs
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	**3.2**	**5.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	**0.0**	**0.6**	**cfs**
Capture Percentage = Q_a/Q_o =		C% =	**100**	**91**	**%**

INLET ON A CONTINUOUS GRADE

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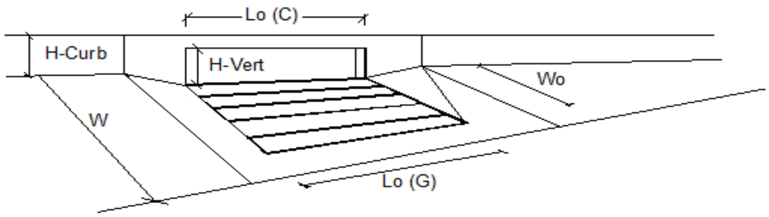

		MINOR	MAJOR	
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Inlet Management*)	**Q_o =**	**3.5**	**7.6**	cfs
Water Spread Width	T =	7.8	11.3	ft
Water Depth at Flowline (outside of local depression)	d =	3.4	4.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.700	0.521	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.1	3.6	cfs
Discharge within the Gutter Section W	Q_w =	2.4	4.0	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.40	0.54	sq ft
Velocity within the Gutter Section W	V_W =	6.1	7.4	fps
Water Depth for Design Condition	d_{LOCAL} =	6.4	7.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.151	0.118	ft/ft
Required Length L_T to Have 100% Interception	L_T =	9.09	15.14	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.00	5.00	ft
Interception Capacity	Q_i =	2.7	3.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.10	0.10	
Effective (Unclogged) Length	L_e =	4.50	4.50	ft
Actual Interception Capacity	**Q_a =**	**2.5**	**3.6**	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**1.0**	**4.0**	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.5**	**3.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.0**	**4.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**71**	**47**	**%**

INLET ON A CONTINUOUS GRADE

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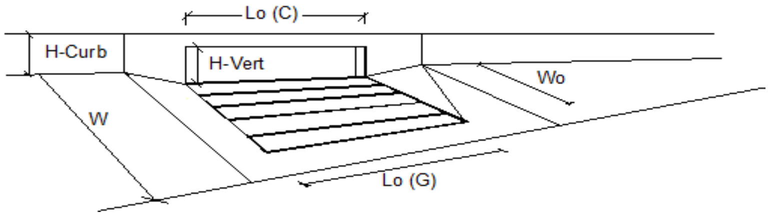
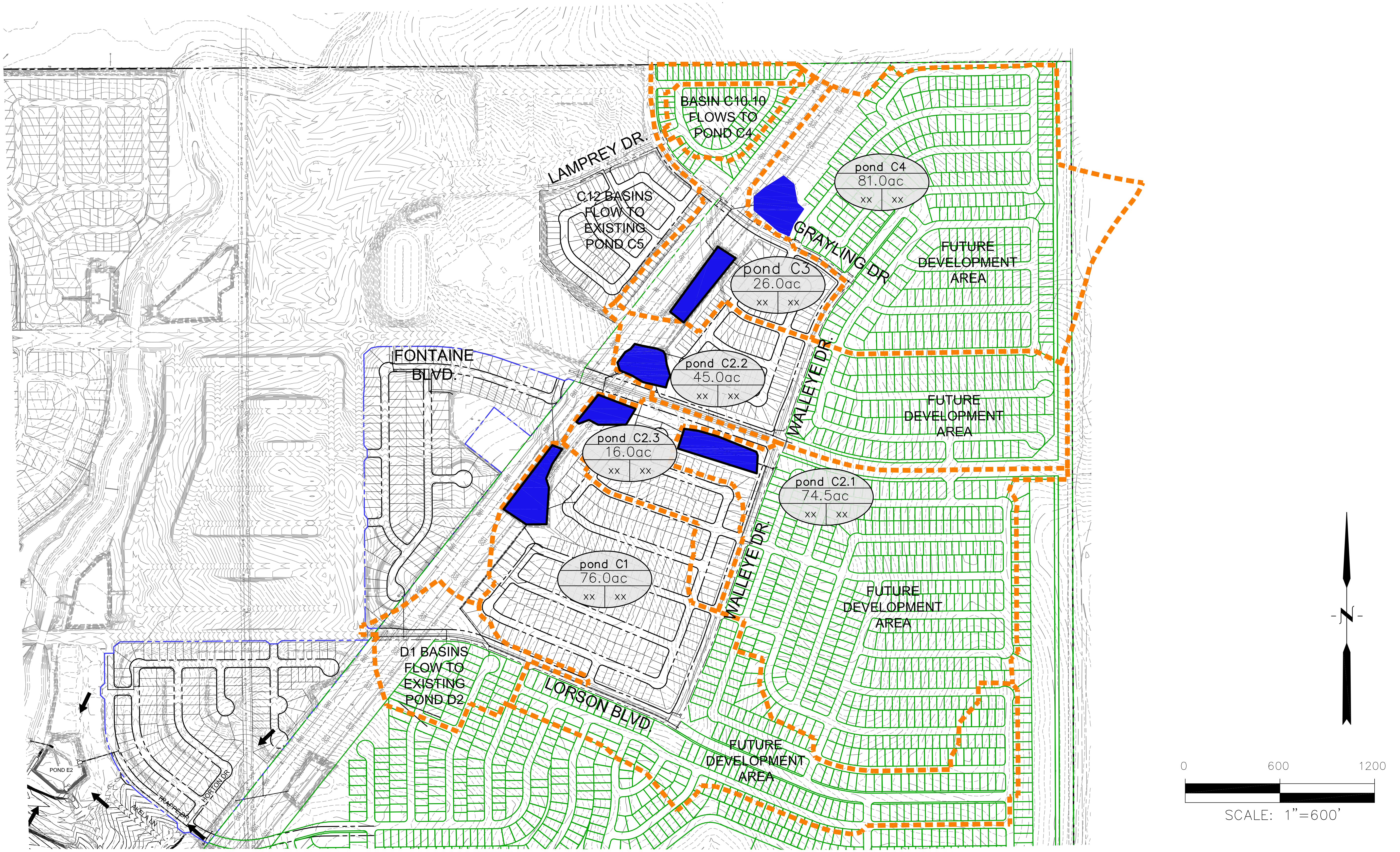


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Inlet Management*)		Q_o =	**2.6**	**9.0**	cfs
Water Spread Width		T =	7.6	13.5	ft
Water Depth at Flowline (outside of local depression)		d =	3.3	4.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.713	0.441	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.8	5.0	cfs
Discharge within the Gutter Section W		Q_w =	1.9	4.0	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.39	0.62	sq ft
Velocity within the Gutter Section W		V_W =	4.7	6.4	fps
Water Depth for Design Condition		d_{LOCAL} =	6.3	7.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		Q_a =	**N/A**	**N/A**	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		Q_b =	**N/A**	**N/A**	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)		S_e =	0.154	0.103	ft/ft
Required Length L_T to Have 100% Interception		L_T =	7.54	17.08	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	7.54	10.00	ft
Interception Capacity		Q_i =	2.6	7.2	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.06	0.06	
Effective (Unclogged) Length		L_e =	8.75	8.75	ft
Actual Interception Capacity		Q_a =	**2.6**	**6.9**	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		Q_b =	**0.0**	**2.1**	cfs
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**2.6**	**6.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.1**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**77**	**%**

APPENDIX D – POND AND ROUTING CALCULATIONS



CORE
ENGINEERING GROUP

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CONTACT: RICHARD L. SCHINDLER, P.E.
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THE HILLS AT LORSON RANCH
WATER QUALITY & POND TRIBUTARY AREAS

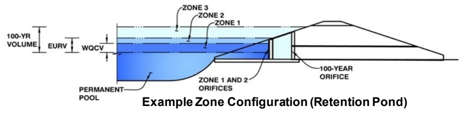
SCALE:	DATE:	FIGURE NO.
NTS	MAY 25, 2020	1

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch

Basin ID: Pond C1



Example Zone Configuration (Retention Pond)

pond bottom=5743.40

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	76.00	acres
Watershed Length =	4,800	ft
Watershed Length to Centroid =	2,100	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	55.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.396	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.503	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.251	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	5.966	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.456	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.398	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	11.003	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	13.015	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	17.139	acre-feet		inches
Approximate 2-yr Detention Volume =	3.431	acre-feet		
Approximate 5-yr Detention Volume =	4.666	acre-feet		
Approximate 10-yr Detention Volume =	6.090	acre-feet		
Approximate 25-yr Detention Volume =	6.620	acre-feet		
Approximate 50-yr Detention Volume =	6.911	acre-feet		
Approximate 100-yr Detention Volume =	7.625	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.396	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.107	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	3.820	acre-feet
Total Detention Basin Volume =	8.323	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.20 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
5743.73	--	0.33	--	--	--	52	0.001	15	0.000
5744	--	0.60	--	--	--	300	0.007	63	0.001
5745	--	1.60	--	--	--	4,017	0.092	2,221	0.051
5746	--	2.60	--	--	--	26,320	0.604	17,389	0.399
5747	--	3.60	--	--	--	56,078	1.287	58,588	1.345
5748	--	4.60	--	--	--	62,238	1.429	117,746	2.703
5749	--	5.60	--	--	--	66,563	1.528	182,147	4.182
5750	--	6.60	--	--	--	70,969	1.629	250,913	5.760
5751	--	7.60	--	--	--	75,495	1.733	324,145	7.441
5752	--	8.60	--	--	--	80,136	1.840	401,960	9.228
5753	--	9.60	--	--	--	85,057	1.953	484,557	11.124
5754	--	10.60	--	--	--	90,000	2.066	572,085	13.133
5755	--	11.60	--	--	--	95,000	2.181	664,585	15.257
5756	--	12.60	--	--	--	100,000	2.296	762,085	17.495
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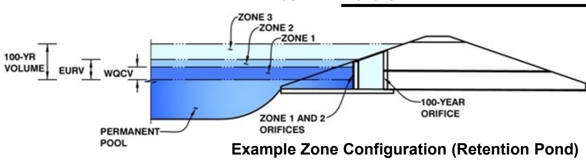
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch
Basin ID: Pond C1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.64	1.396	Orifice Plate
Zone 2 (EURV)	5.81	3.107	Rectangular Orifice
Z3 (100+1/2WQCV)	8.11	3.820	Weir&Pipe (Restrict)
Total (all zones)		8.323	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.64	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	14.60	inches
Orifice Plate: Orifice Area per Row =	3.74	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.597E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.21	2.43					
Orifice Area (sq. inches)	3.74	3.74	3.74					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.64	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.81	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	19.74		inches

Calculated Parameters for Vertical Orifi

	Zone 2 Rectangular	Not Selected
Vertical Orifice Area =	0.82	N/A
Vertical Orifice Centroid =	0.25	N/A

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.10	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.66	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow We

	Zone 3 Weir	Not Selected
Height of Grate Upper Edge, H_t =	6.10	N/A
Overflow Weir Slope Length =	3.00	N/A
Grate Open Area / 100-yr Orifice Area =	9.41	N/A
Overflow Grate Open Area w/o Debris =	11.89	N/A
Overflow Grate Open Area w/ Debris =	5.94	N/A

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	12.10		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected
Outlet Orifice Area =	1.26	N/A
Outlet Orifice Centroid =	0.57	N/A
Half-Central Angle of Restrictor Plate on Pipe =	1.92	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	28.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.16	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.44	feet
Stage at Top of Freeboard =	12.60	feet
Basin Area at Top of Freeboard =	2.30	acres
Basin Volume at Top of Freeboard =	17.50	acre-ft

pond bottom = 0 = 5743.40

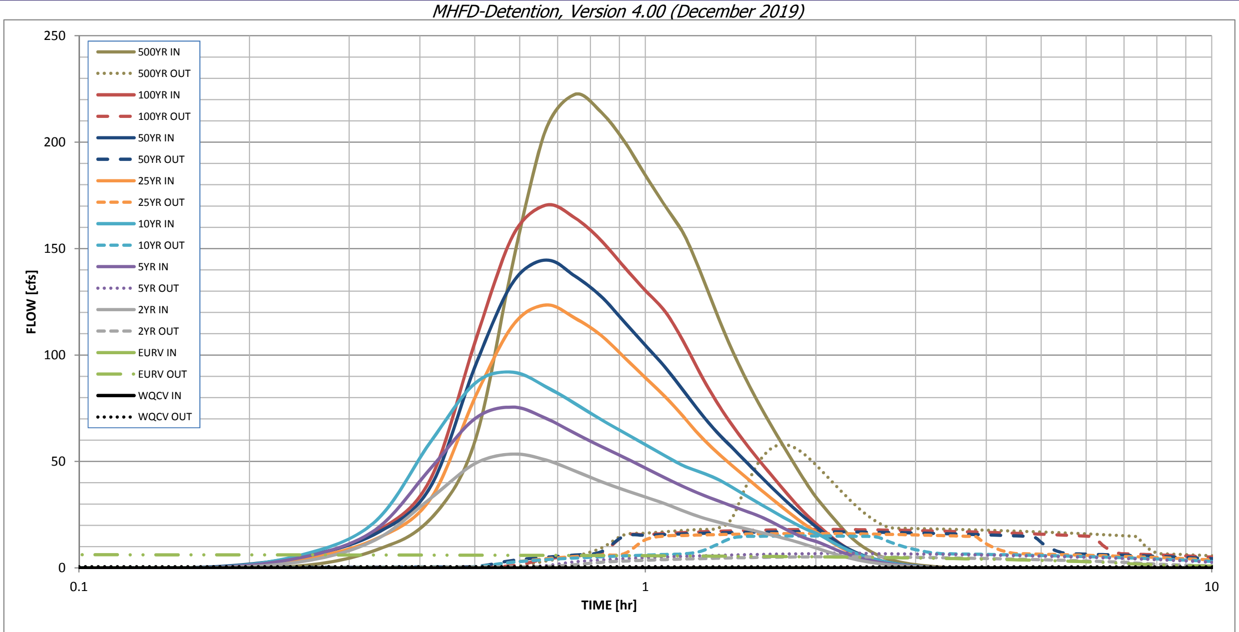
Routed Hydrograph Results

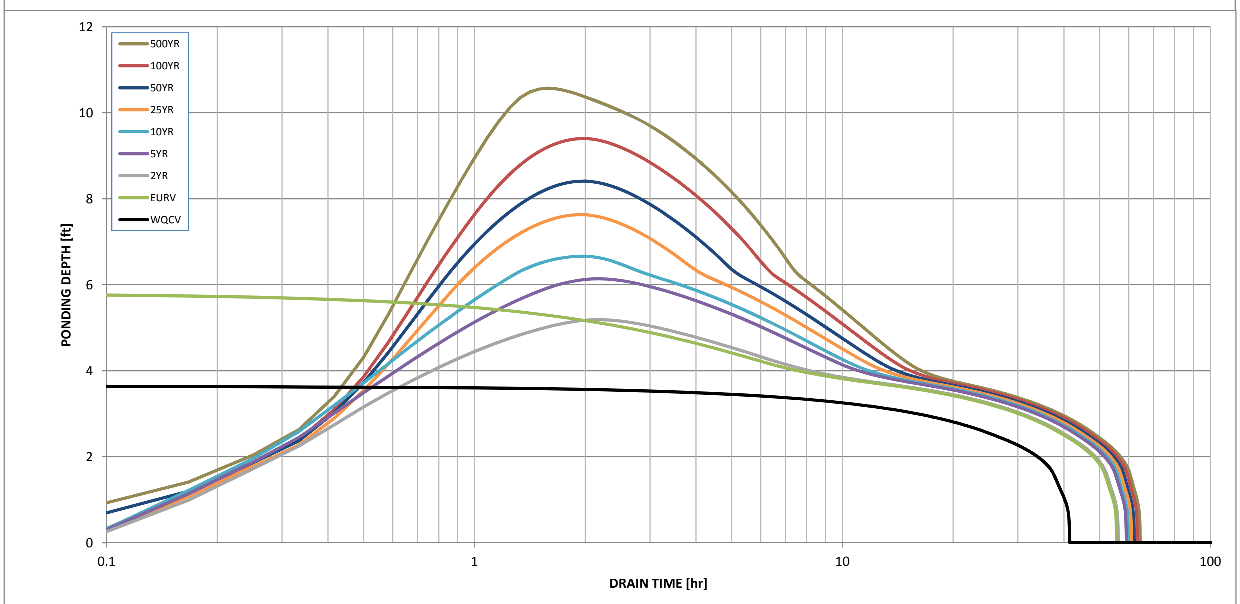
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

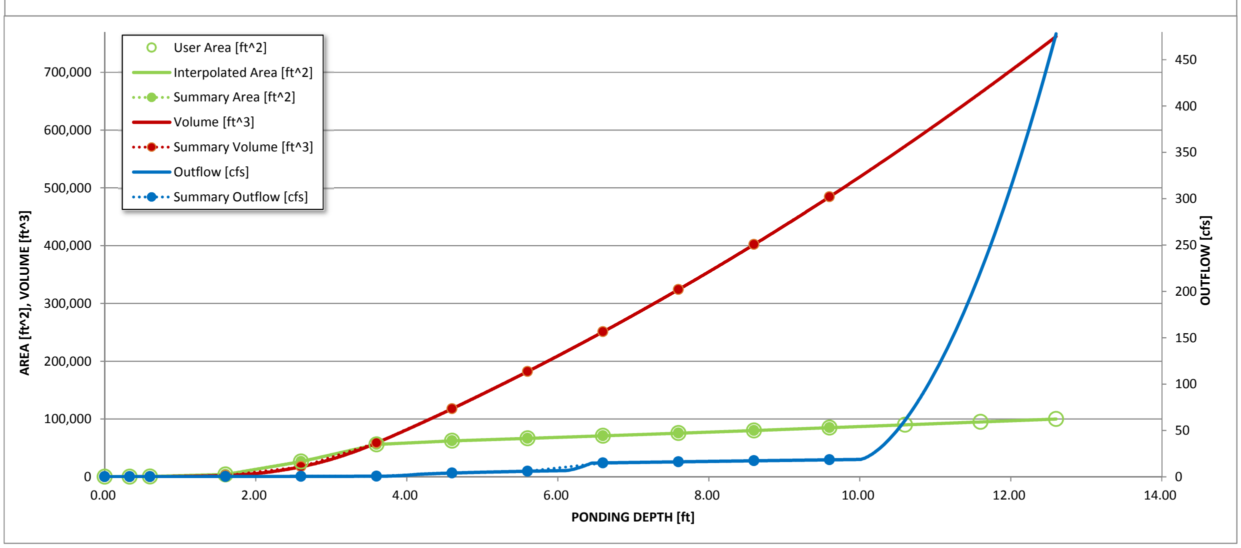
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	1.396	4.503	4.251	5.966	7.456	9.398	11.003	13.015
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.251	5.966	7.456	9.398	11.003	13.015
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	5.7	16.2	25.0	45.9	57.7	74.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.21	0.33	0.60	0.76	0.98
Peak Inflow Q (cfs) =	N/A	N/A	53.5	75.6	91.9	123.5	144.7	170.4
Peak Outflow Q (cfs) =	0.6	6.3	5.3	7.1	15.0	16.2	17.0	18.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.4	0.3	0.2
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.6	0.6	0.6	0.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	48	49	50	49	48	47	46
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	53	55	55	55	55	56
Maximum Ponding Depth (ft) =	3.64	5.81	5.19	6.14	6.66	7.63	8.41	9.40
Area at Maximum Ponding Depth (acres) =	1.29	1.55	1.49	1.58	1.64	1.74	1.82	1.93
Maximum Volume Stored (acre-ft) =	1.397	4.505	3.548	5.006	5.858	7.493	8.862	10.736

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.04	1.17
	0:15:00	0.00	0.00	3.21	5.25	6.50	4.37	5.65	5.35	8.30
	0:20:00	0.00	0.00	13.15	17.89	21.81	13.53	16.01	16.83	22.90
	0:25:00	0.00	0.00	32.51	46.49	58.89	32.12	37.80	41.36	59.51
	0:30:00	0.00	0.00	49.01	70.15	86.70	79.84	94.50	105.98	143.35
	0:35:00	0.00	0.00	53.50	75.56	91.94	113.93	134.11	156.12	205.77
	0:40:00	0.00	0.00	50.76	70.34	85.18	123.53	144.65	170.44	222.50
	0:45:00	0.00	0.00	45.62	63.33	77.42	117.46	137.22	164.57	214.42
	0:50:00	0.00	0.00	40.68	57.25	69.85	109.47	127.83	154.14	200.67
	0:55:00	0.00	0.00	36.68	51.94	63.56	99.08	115.78	141.50	184.45
	1:00:00	0.00	0.00	33.32	46.99	57.93	89.35	104.59	130.33	170.05
	1:05:00	0.00	0.00	30.16	42.30	52.71	80.48	94.37	120.48	157.26
	1:10:00	0.00	0.00	26.80	38.16	48.05	71.14	83.50	106.47	139.23
	1:15:00	0.00	0.00	23.93	34.81	45.03	62.00	72.87	91.26	120.06
	1:20:00	0.00	0.00	21.79	31.93	42.03	54.66	64.30	78.39	103.47
	1:25:00	0.00	0.00	20.06	29.26	38.18	48.56	57.10	67.84	89.53
	1:30:00	0.00	0.00	18.49	26.81	34.21	42.90	50.35	58.80	77.50
	1:35:00	0.00	0.00	16.99	24.50	30.55	37.64	44.04	50.99	67.10
	1:40:00	0.00	0.00	15.50	21.77	27.14	32.80	38.24	43.80	57.54
	1:45:00	0.00	0.00	14.01	18.85	23.90	28.26	32.83	37.08	48.66
	1:50:00	0.00	0.00	12.61	16.16	20.96	24.03	27.80	30.90	40.50
	1:55:00	0.00	0.00	10.93	13.95	18.31	20.21	23.27	25.43	33.31
	2:00:00	0.00	0.00	9.49	12.47	16.37	17.03	19.54	20.89	27.55
	2:05:00	0.00	0.00	7.95	10.63	13.90	13.96	16.01	16.79	22.24
	2:10:00	0.00	0.00	6.45	8.62	11.29	10.99	12.60	13.04	17.30
	2:15:00	0.00	0.00	5.19	6.89	9.06	8.59	9.84	9.97	13.24
	2:20:00	0.00	0.00	4.19	5.52	7.27	6.74	7.71	7.64	10.15
	2:25:00	0.00	0.00	3.35	4.42	5.78	5.30	6.05	5.81	7.73
	2:30:00	0.00	0.00	2.67	3.51	4.56	4.15	4.71	4.40	5.85
	2:35:00	0.00	0.00	2.11	2.75	3.53	3.21	3.63	3.33	4.41
	2:40:00	0.00	0.00	1.67	2.12	2.71	2.47	2.78	2.57	3.39
	2:45:00	0.00	0.00	1.31	1.63	2.07	1.90	2.13	1.99	2.62
	2:50:00	0.00	0.00	1.02	1.26	1.62	1.49	1.67	1.58	2.08
	2:55:00	0.00	0.00	0.77	0.95	1.24	1.14	1.28	1.22	1.61
	3:00:00	0.00	0.00	0.56	0.69	0.91	0.86	0.96	0.91	1.20
	3:05:00	0.00	0.00	0.38	0.48	0.64	0.61	0.68	0.65	0.85
	3:10:00	0.00	0.00	0.24	0.32	0.41	0.40	0.45	0.43	0.56
	3:15:00	0.00	0.00	0.13	0.19	0.24	0.24	0.27	0.25	0.33
	3:20:00	0.00	0.00	0.06	0.09	0.11	0.12	0.13	0.12	0.16
	3:25:00	0.00	0.00	0.02	0.03	0.03	0.04	0.04	0.04	0.05
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
micropool	0.00	40	0.001	0	0.000	0.00
surcharge	0.33	52	0.001	15	0.000	0.07
5744	0.60	300	0.007	63	0.001	0.10
5745	1.60	4,017	0.092	2,221	0.051	0.24
5746	2.60	26,320	0.604	17,389	0.399	0.40
5747	3.60	56,078	1.287	58,588	1.345	0.57
5748	4.60	62,238	1.429	117,746	2.703	4.02
5749	5.60	66,563	1.528	182,147	4.182	5.96
5750	6.60	70,969	1.629	250,913	5.760	14.94
5751	7.60	75,495	1.733	324,145	7.441	16.13
5752	8.60	80,136	1.840	401,960	9.228	17.24
5753	9.60	85,057	1.953	484,557	11.124	18.28

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**April 30, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C1**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 55.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.550

C) Contributing Watershed Area — Area = 76.000 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = ____ in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- (●) Water Quality Capture Volume (WQCV)
- ( ) Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$) — V_{DESIGN}= 1.396 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$ — $V_{DESIGN\ OTHER}$= ____ ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$= ____ ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = ____ %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = ____ %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = ____ %

J) Excess Urban Runoff Volume (EURV) Design Volume — $EURV_{DESIGN}$ = ____ ac-f t
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$= ____ ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 3.00 ft / ft

DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations: ____

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.042 ac-ft

B) Actual Forebay Volume — V_F = 0.045 ac-ft

C) Forebay Depth (D_F = 30 inch maximum) — D_F = 24.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 170.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 3.40 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = ____ in

G) Rectangular Notch Width — Calculated W_N = 9.1 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Richard Schindler
Company: Core Engineering Group
Date: April 30, 2020
Project: The Hills at Lorson Ranch
Location: Pond C1

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 50 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 1.93 inches

E) Total Outlet Area — A_{ot} = 6.45 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 182 cu ft

C) Initial Surcharge Provided Above Micropool — V_s= 16.7 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 207 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *Other (Please describe below)*

wellscreen stainless

Other (Y/N): y

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio = 0.6

D) Total Water Quality Screen Area (based on screen type) — A_{total}= 345 sq. in. **Based on type 'Other' screen ratio**

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 3.64 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 71.68 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Weir Report

Pond C1 forebay overflow

Rectangular Weir

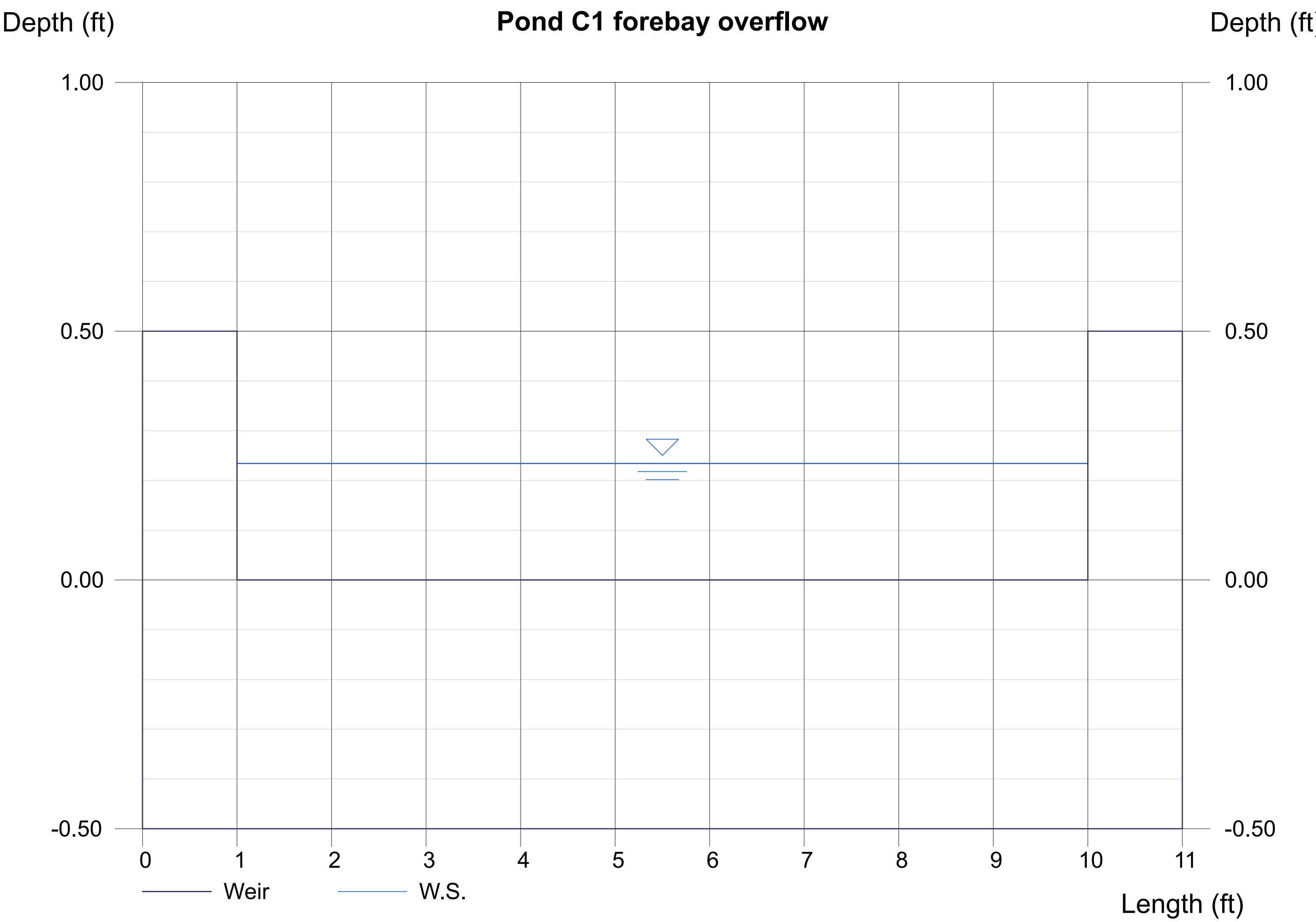
Crest	=	Sharp
Bottom Length (ft)	=	9.00
Total Depth (ft)	=	0.50

Calculations

Weir Coeff. Cw	=	3.33
Compute by:		Known Q
Known Q (cfs)	=	3.40

Highlighted

Depth (ft)	=	0.23
Q (cfs)	=	3.400
Area (sqft)	=	2.11
Velocity (ft/s)	=	1.61
Top Width (ft)	=	9.00



Channel Report

pond C1 low flow channel (2 x forebay release = 6.8cfs)

Rectangular

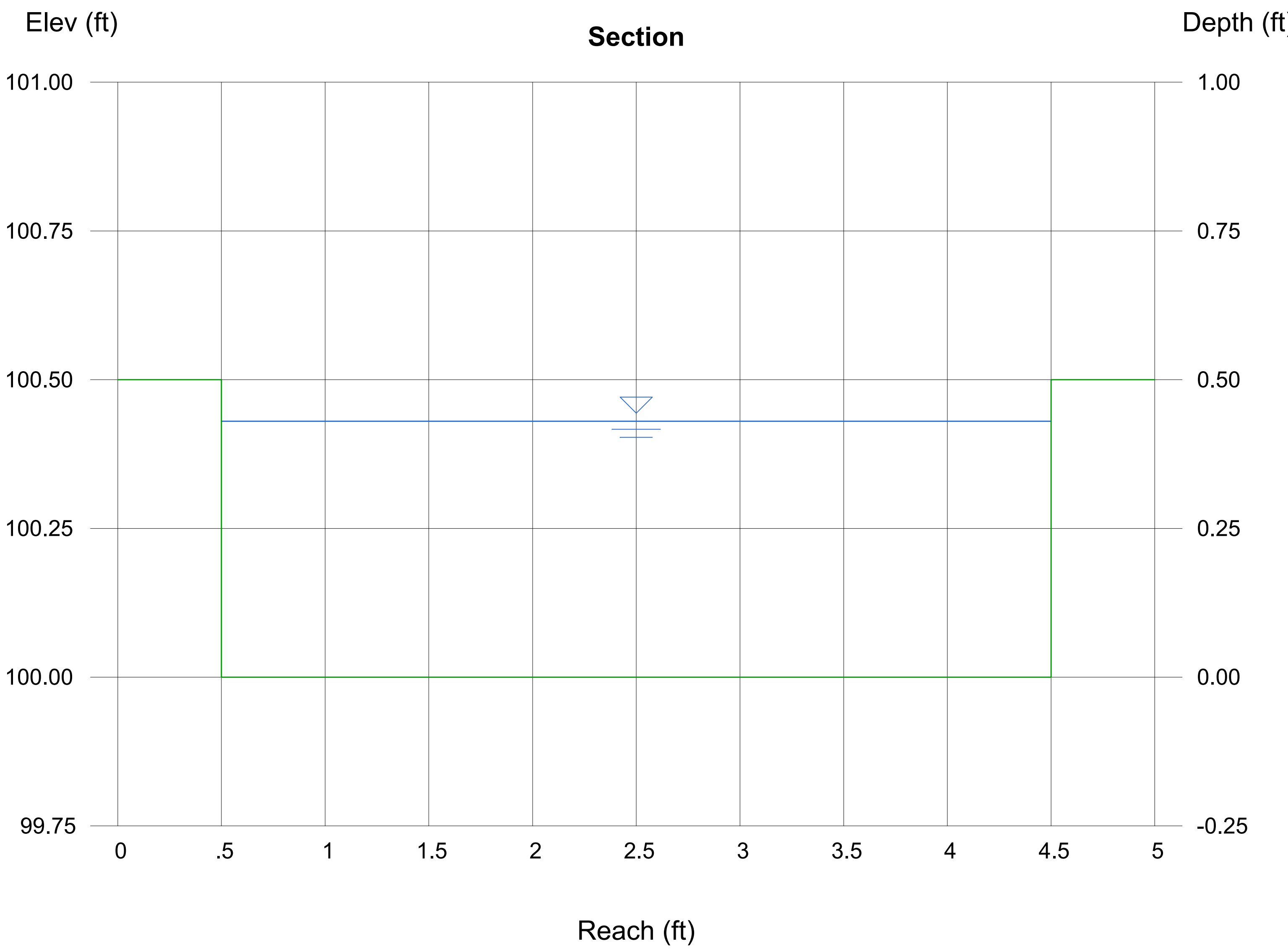
Botom Width (ft)	= 4.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.80

Highlighted

Depth (ft)	= 0.43
Q (cfs)	= 6.800
Area (sqft)	= 1.72
Velocity (ft/s)	= 3.95
Wetted Perim (ft)	= 4.86
Crit Depth, Yc (ft)	= 0.45
Top Width (ft)	= 4.00
EGL (ft)	= 0.67

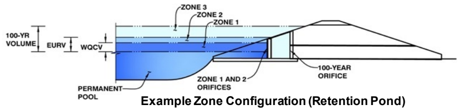


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch

Basin ID: Pond C2.1



Example Zone Configuration (Retention Pond)

top micropool-5760.00

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	74.50	acres		
Watershed Length =	2,500	ft		
Watershed Length to Centroid =	2,000	ft		
Watershed Slope =	0.038	ft/ft		
Watershed Imperviousness =	55.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.368	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.414	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.152	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	5.828	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.285	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.182	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	10.750	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	12.716	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	16.746	acre-feet		inches
Approximate 2-yr Detention Volume =	3.363	acre-feet		
Approximate 5-yr Detention Volume =	4.574	acre-feet		
Approximate 10-yr Detention Volume =	5.970	acre-feet		
Approximate 25-yr Detention Volume =	6.490	acre-feet		
Approximate 50-yr Detention Volume =	6.774	acre-feet		
Approximate 100-yr Detention Volume =	7.475	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.368	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.045	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	3.745	acre-feet
Total Detention Basin Volume =	8.159	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.20 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	42	0.001		
5760.33	--	0.33	--	--	--	50	0.001	15	0.000
5761	--	1.00	--	--	--	1,264	0.029	455	0.010
5762	--	2.00	--	--	--	20,478	0.470	11,326	0.260
5763	--	3.00	--	--	--	41,417	0.951	42,274	0.970
5764	--	4.00	--	--	--	44,796	1.028	85,380	1.960
5765	--	5.00	--	--	--	48,239	1.107	131,898	3.028
5766	--	6.00	--	--	--	51,758	1.188	181,896	4.176
5767	--	7.00	--	--	--	55,348	1.271	235,449	5.405
5768	--	8.00	--	--	--	59,010	1.355	292,628	6.718
5769	--	9.00	--	--	--	62,743	1.440	353,505	8.115
5770	--	10.00	--	--	--	66,548	1.528	418,150	9.599
5771	--	11.00	--	--	--	70,423	1.617	486,636	11.172
5772	--	12.00	--	--	--	74,434	1.709	559,064	12.834
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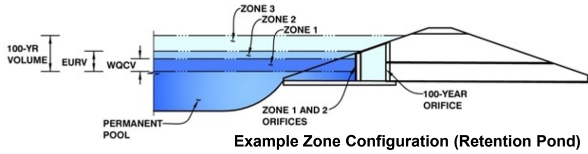
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch
Basin ID: Pond C2.1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.42	1.368	Orifice Plate
Zone 2 (EURV)	6.20	3.045	Rectangular Orifice
3 (100+1/2WQCV)	9.04	3.745	Weir&Pipe (Restrict)
Total (all zones)		8.159	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.42	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	13.70	inches
Orifice Plate: Orifice Area per Row =	4.06	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.819E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.14	2.28					
Orifice Area (sq. inches)	4.06	4.06	4.06					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.42	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	6.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	14.59		inches

Calculated Parameters for Vertical Orifi

	Zone 2 Rectangular	Not Selected
Vertical Orifice Area =	0.61	N/A
Vertical Orifice Centroid =	0.25	N/A

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow We

	Zone 3 Weir	Not Selected
Height of Grate Upper Edge, H_t =	6.20	N/A
Overflow Weir Slope Length =	6.00	N/A
Grate Open Area / 100-yr Orifice Area =	6.84	N/A
Overflow Grate Open Area w/o Debris =	33.60	N/A
Overflow Grate Open Area w/ Debris =	16.80	N/A

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	30.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected
Outlet Orifice Area =	4.91	N/A
Outlet Orifice Centroid =	1.25	N/A
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.30	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	25.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.01	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.69	feet
Stage at Top of Freeboard =	12.00	feet
Basin Area at Top of Freeboard =	1.71	acres
Basin Volume at Top of Freeboard =	12.83	acre-ft

top micropool = 5760 = stage 0

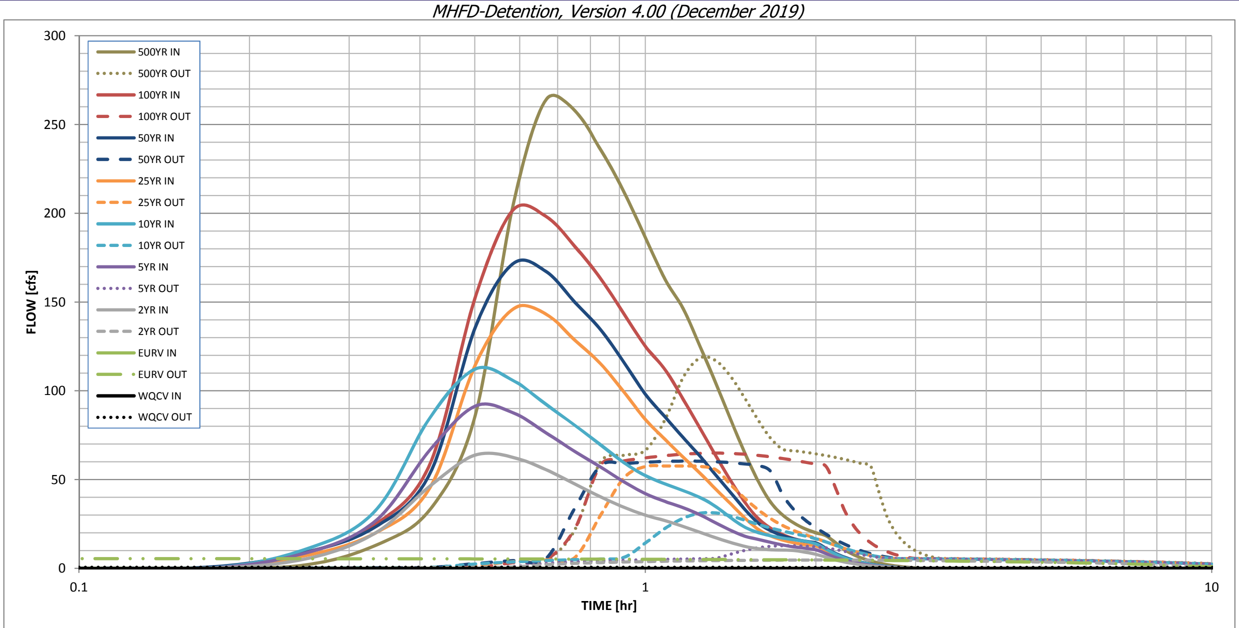
Routed Hydrograph Results

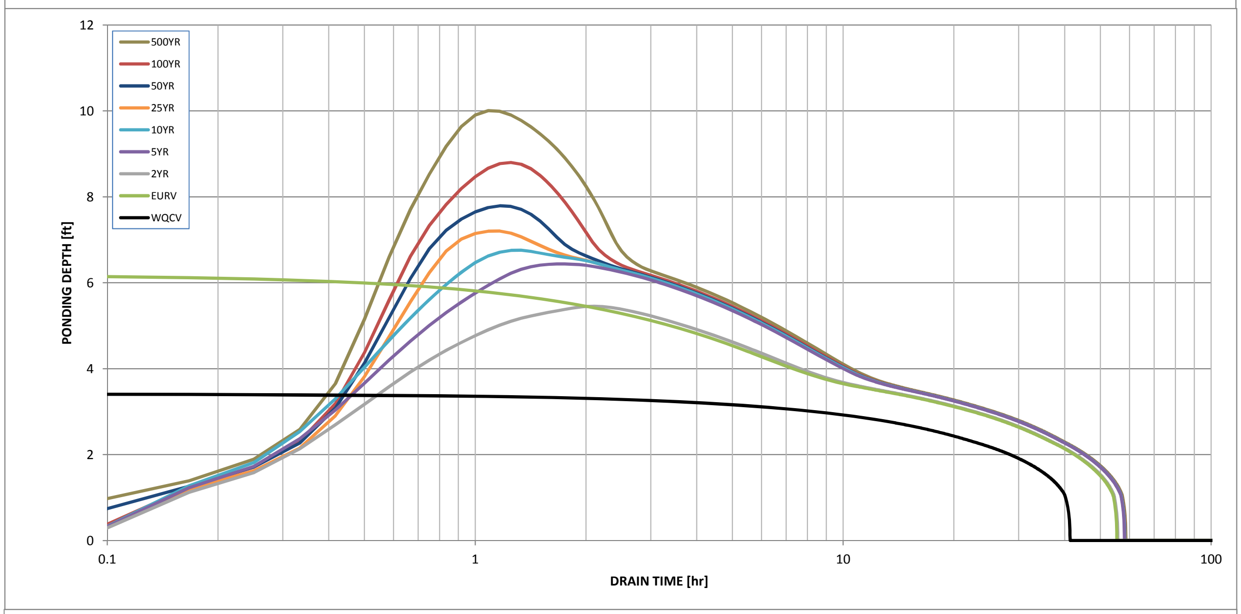
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

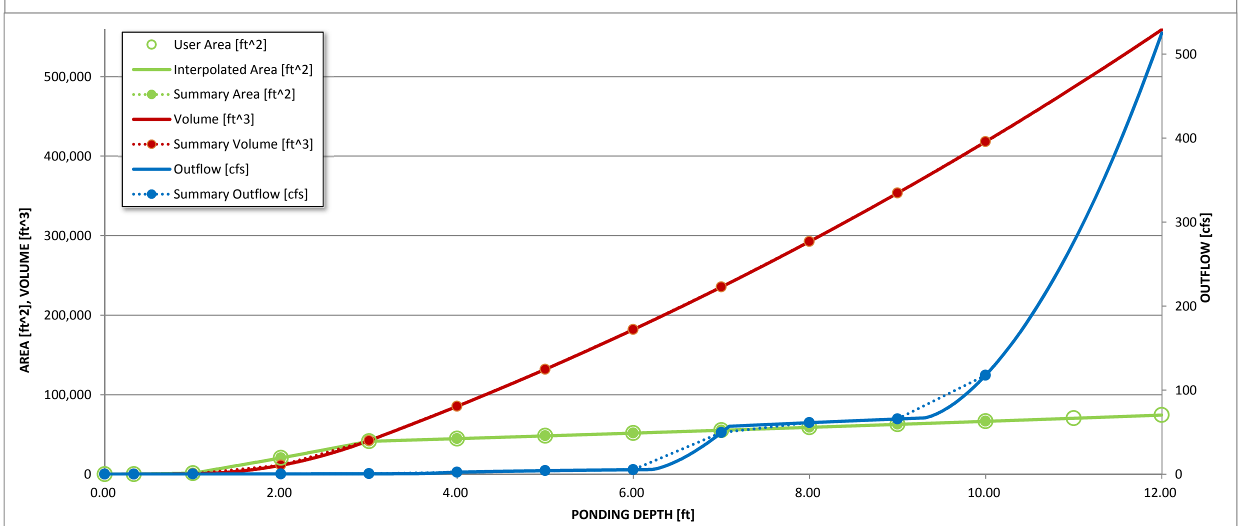
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	1.368	4.414	4.152	5.828	7.285	9.182	10.750	12.716
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.152	5.828	7.285	9.182	10.750	12.716
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	7.5	21.2	32.2	57.6	72.4	92.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.28	0.43	0.77	0.97	1.24
Peak Inflow Q (cfs) =	N/A	N/A	63.8	91.4	112.2	146.0	171.6	201.7
Peak Outflow Q (cfs) =	0.6	5.6	4.8	12.8	31.2	57.7	60.5	65.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	1.0	1.0	0.8	0.7
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.8	1.5	1.6	1.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	48	48	49	47	45	43	41
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	53	54	53	52	52	51
Maximum Ponding Depth (ft) =	3.42	6.20	5.45	6.44	6.76	7.20	7.79	8.80
Area at Maximum Ponding Depth (acres) =	0.98	1.20	1.14	1.22	1.25	1.29	1.34	1.42
Maximum Volume Stored (acre-ft) =	1.377	4.415	3.534	4.694	5.090	5.661	6.435	7.829

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: *.\xxxxxxx.xlsx*

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.06	1.91
	0:15:00	0.00	0.00	5.22	8.54	10.59	7.11	9.03	8.69	12.94
	0:20:00	0.00	0.00	19.89	26.61	32.39	19.92	23.33	24.81	33.21
	0:25:00	0.00	0.00	46.47	66.84	85.05	45.56	53.57	58.95	85.49
	0:30:00	0.00	0.00	63.77	91.36	112.23	114.18	135.21	152.14	203.98
	0:35:00	0.00	0.00	62.57	87.72	105.94	146.00	171.56	201.73	263.77
	0:40:00	0.00	0.00	55.70	76.50	92.49	143.34	167.40	198.39	257.96
	0:45:00	0.00	0.00	47.59	65.90	80.77	128.66	150.06	181.55	235.82
	0:50:00	0.00	0.00	40.32	57.13	69.55	115.30	134.50	163.30	212.14
	0:55:00	0.00	0.00	34.42	48.76	59.53	99.33	116.01	143.36	186.25
	1:00:00	0.00	0.00	29.96	42.11	52.29	83.84	98.09	125.09	162.81
	1:05:00	0.00	0.00	26.93	37.69	47.58	72.69	85.28	111.97	146.17
	1:10:00	0.00	0.00	23.58	34.19	43.72	62.57	73.59	95.11	124.77
	1:15:00	0.00	0.00	20.26	30.12	39.98	53.50	63.03	78.69	103.88
	1:20:00	0.00	0.00	17.23	25.50	34.67	44.42	52.30	63.05	83.27
	1:25:00	0.00	0.00	14.49	21.34	28.37	36.12	42.44	49.07	64.63
	1:30:00	0.00	0.00	12.33	18.09	23.14	28.26	33.06	37.14	48.88
	1:35:00	0.00	0.00	11.11	16.33	20.17	21.86	25.47	27.88	36.96
	1:40:00	0.00	0.00	10.58	14.63	18.35	18.19	21.12	22.45	29.88
	1:45:00	0.00	0.00	10.28	13.15	17.06	15.89	18.35	19.04	25.36
	1:50:00	0.00	0.00	10.11	12.11	16.15	14.38	16.52	16.67	22.22
	1:55:00	0.00	0.00	9.09	11.32	15.20	13.33	15.24	15.02	20.01
	2:00:00	0.00	0.00	8.00	10.49	13.83	12.66	14.40	13.84	18.42
	2:05:00	0.00	0.00	6.32	8.33	10.89	10.10	11.46	10.78	14.34
	2:10:00	0.00	0.00	4.73	6.18	8.03	7.42	8.39	7.80	10.35
	2:15:00	0.00	0.00	3.55	4.59	5.92	5.50	6.20	5.78	7.65
	2:20:00	0.00	0.00	2.63	3.40	4.33	4.06	4.57	4.29	5.66
	2:25:00	0.00	0.00	1.93	2.46	3.15	2.96	3.32	3.16	4.16
	2:30:00	0.00	0.00	1.39	1.74	2.27	2.12	2.37	2.27	2.99
	2:35:00	0.00	0.00	0.98	1.22	1.62	1.53	1.71	1.64	2.15
	2:40:00	0.00	0.00	0.66	0.84	1.12	1.08	1.21	1.15	1.52
	2:45:00	0.00	0.00	0.41	0.55	0.72	0.71	0.79	0.76	0.99
	2:50:00	0.00	0.00	0.22	0.32	0.40	0.42	0.46	0.44	0.58
	2:55:00	0.00	0.00	0.09	0.15	0.18	0.20	0.22	0.21	0.27
	3:00:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.06	0.08
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
top micropool	0.00	42	0.001	0	0.000	0.00
surcharge	0.33	50	0.001	15	0.000	0.08
5761	1.00	1,264	0.029	455	0.010	0.14
5762	2.00	20,478	0.470	11,326	0.260	0.32
5763	3.00	41,417	0.951	42,274	0.970	0.54
5764	4.00	44,796	1.028	85,380	1.960	2.36
5765	5.00	48,239	1.107	131,898	3.028	4.17
5766	6.00	51,758	1.188	181,896	4.176	5.36
5767	7.00	55,348	1.271	235,449	5.405	49.52
5768	8.00	59,010	1.355	292,628	6.718	61.41
5769	9.00	62,743	1.440	353,505	8.115	65.80
5770	10.00	66,548	1.528	418,150	9.599	117.77

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**May 2, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C2.1**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 55.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.550

C) Contributing Watershed Area — Area = 74.500 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = ____ in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- (●) Water Quality Capture Volume (WQCV)
- ( ) Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$) — V_{DESIGN} = 1.368 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = ____ ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$ = ____ ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = ____ %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = ____ %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = ____ %

J) Excess Urban Runoff Volume (EURV) Design Volume — $EURV_{DESIGN}$ = ____ ac-f t
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$ = ____ ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 3.00 ft / ft

DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.041 ac-ft

B) Actual Forebay Volume — V_F = 0.045 ac-ft

C) Forebay Depth (D_F = 30 inch maximum) — D_F = 24.0 in

D) Forebay Discharge

- i) Undetained 100-year Peak Discharge — Q_{100} = 202.00 cfs
- ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 4.04 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = ____ in

G) Rectangular Notch Width — Calculated W_N = 9.9 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**May 2, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C2.1**

6. Trickle Channel

A) Type of Trickle Channel

Choose One
- (●) Concrete
- ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 50 sq ft

C) Outlet Type

Choose One
- (●) Orifice Plate
- ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 2.01 inches

E) Total Outlet Area — A_{ot} = 12.60 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 179 cu ft

C) Initial Surcharge Provided Above Micropool — V_s= 16.7 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 401 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *Other (Please describe below)*

wellscreen stainless

Other (Y/N): y

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio = 0.6

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 668 sq. in. **Based on type 'Other' screen ratio**

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 3.42 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 69.04 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**May 2, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C2.1**

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = ______ ft / ft

11. Vegetation

Choose One
- Irrigated
- Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

Notes:

Channel Report

pond C2.1 low flow channel (2 x forebay release = 8.08cfs)

Rectangular

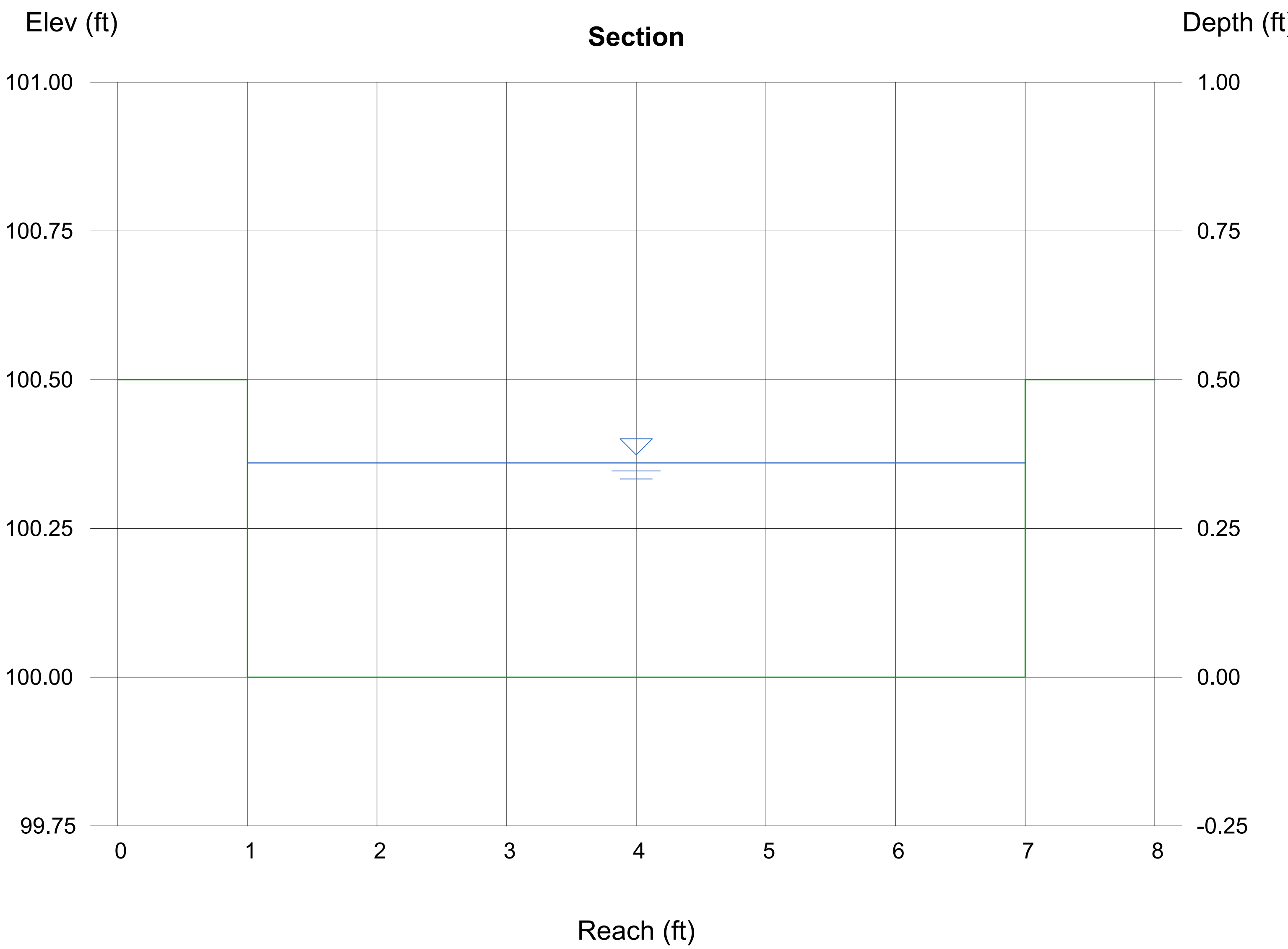
Botom Width (ft)	= 6.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.08

Highlighted

Depth (ft)	= 0.36
Q (cfs)	= 8.080
Area (sqft)	= 2.16
Velocity (ft/s)	= 3.74
Wetted Perim (ft)	= 6.72
Crit Depth, Yc (ft)	= 0.39
Top Width (ft)	= 6.00
EGL (ft)	= 0.58



Weir Report

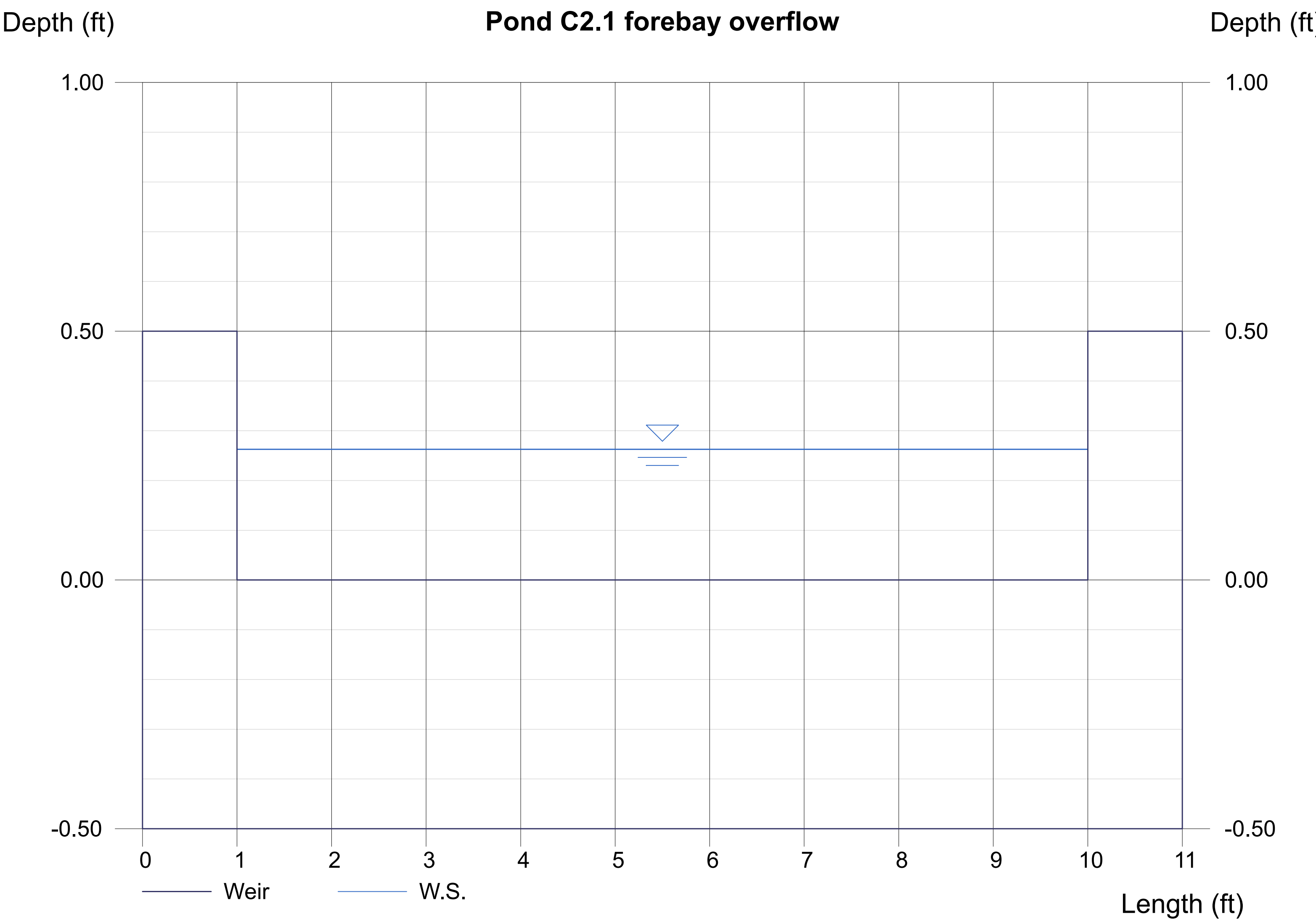
Hydraflow Express by Intelisolve | Saturday, May 2 2020, 7:52 AM

Pond C2.1 forebay overflow

Rectangular Weir
Crest = Sharp
Bottom Length (ft) = 9.00
Total Depth (ft) = 0.50

Calculations
Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 4.04

Highlighted
Depth (ft) = 0.26
Q (cfs) = 4.040
Area (sqft) = 2.36
Velocity (ft/s) = 1.71
Top Width (ft) = 9.00

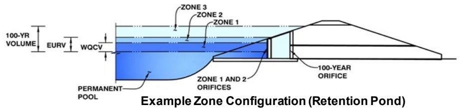


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch

Basin ID: Pond C2.2



Example Zone Configuration (Retention Pond)

micropool = 0 = 5744.00

Depth Increment = 0.20 ft

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	45.00	acres		
Watershed Length =	2,500	ft		
Watershed Length to Centroid =	1,200	ft		
Watershed Slope =	0.045	ft/ft		
Watershed Imperviousness =	55.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	95.0%	percent		
Percentage Hydrologic Soil Groups C/D =	5.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.827	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.651	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.510	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.521	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.403	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.541	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	6.487	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	7.671	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	10.104	acre-feet		inches
Approximate 2-yr Detention Volume =	2.035	acre-feet		
Approximate 5-yr Detention Volume =	2.778	acre-feet		
Approximate 10-yr Detention Volume =	3.600	acre-feet		
Approximate 25-yr Detention Volume =	3.912	acre-feet		
Approximate 50-yr Detention Volume =	4.081	acre-feet		
Approximate 100-yr Detention Volume =	4.507	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.827	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.824	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	2.269	acre-feet
Total Detention Basin Volume =	4.920	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
5744.33	--	0.33	--	--	--	50	0.001	15	0.000
5745	--	1.00	--	--	--	255	0.006	117	0.003
5746	--	2.00	--	--	--	6,998	0.161	3,743	0.086
5747	--	3.00	--	--	--	38,392	0.881	26,438	0.607
5748	--	4.00	--	--	--	40,927	0.940	66,098	1.517
5749	--	5.00	--	--	--	43,534	0.999	108,328	2.487
5750	--	6.00	--	--	--	46,212	1.061	153,201	3.517
5751	--	7.00	--	--	--	48,991	1.125	200,803	4.610
5752	--	8.00	--	--	--	51,837	1.190	251,217	5.767
5753	--	9.00	--	--	--	54,731	1.256	304,501	6.990
5754	--	10.00	--	--	--	58,033	1.332	360,883	8.285
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Pond C2.2 Developed Inflow Hydrograph---- Pond C3 outflow + C5 Basin + C7 Basin

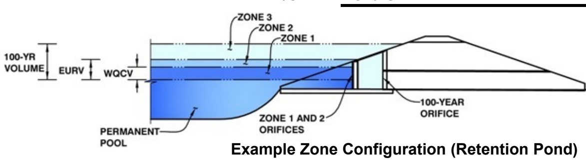
Time [hr]	Time [min]	2 Year Pond C3 Outflow2 - [cfs]	CUHP 2 Year [cfs]	2yr Combined Hydrograph	5 Year Pond C3 Outflow2 - [cfs]	CUHP 5 Year [cfs]	5yr Combined Hydrograph	10 Year Ponc C3 Outflow2 - [cfs]	CUHP 10 Year [cfs]	10yr Combined Hydrograph	25 Year Pond C3 Outflow2 - [cfs]	CUHP 25 Year [cfs]	25yr Combined Hydrograph	50 Year Pond C3 Outflow2 - [cfs]	CUHP 50 Year [cfs]	50yr Combined Hydrograph	100 Year Pond C3 Outflow2 - [cfs]	CUHP 100 Year [cfs]	100yr Combined Hydrograph	500 Year Pond C3 Outflow2 - [cfs]	CUHP 500 Year [cfs]	500yr Combined Hydrograph
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.02	0.00	0.02	0.03	0.00	0.03
0.08	5.00	0.03	0.00	0.03	0.03	0.00	0.03	0.03	0.00	0.03	0.03	0.00	0.03	0.04	0.00	0.04	0.03	0.00	0.03	0.04	0.00	0.04
0.17	10.00	0.06	0.00	0.06	0.07	0.00	0.07	0.08	0.00	0.08	0.07	0.00	0.07	0.08	0.42	0.50	0.07	0.04	0.11	0.09	1.36	1.45
0.25	15.00	0.10	3.74	3.84	0.11	6.11	6.22	0.11	7.57	7.68	0.10	5.09	5.19	0.10	6.38	6.48	0.10	6.20	6.30	0.12	9.01	9.13
0.33	20.00	0.14	13.60	13.74	0.16	18.00	18.16	0.17	21.92	22.09	0.14	13.38	13.52	0.15	15.61	15.76	0.16	16.68	16.84	0.17	22.29	22.46
0.42	25.00	0.17	31.11	31.28	0.20	45.07	45.27	0.52	57.54	58.06	0.19	30.50	30.69	0.24	35.87	36.11	0.39	39.63	40.02	1.63	57.77	59.40
0.50	30.00	0.24	40.82	41.06	1.21	58.25	59.46	1.95	71.19	73.14	1.68	76.90	78.58	2.14	91.05	93.19	2.56	102.55	105.11	3.27	136.67	139.94
0.58	35.00	0.87	38.60	39.47	2.10	53.89	55.99	2.57	65.04	67.61	2.72	92.11	94.83	3.16	108.06	111.22	3.60	127.72	131.32	4.27	166.67	170.94
0.67	40.00	1.66	33.84	35.50	2.52	46.24	48.76	2.99	55.88	58.87	3.44	88.47	91.91	3.89	103.22	107.11	4.32	122.26	126.58	4.98	158.77	163.75
0.75	45.00	2.01	28.43	30.44	2.81	39.40	42.21	3.35	48.41	51.76	3.99	77.76	81.75	4.43	90.67	95.10	4.86	110.23	115.09	5.54	143.17	148.71
0.83	50.00	2.25	23.82	26.07	3.03	33.85	36.88	3.70	41.10	44.80	4.43	69.49	73.92	4.85	81.04	85.89	5.29	98.35	103.64	20.24	127.67	147.91
0.92	55.00	2.44	20.11	22.55	3.21	28.41	31.62	4.03	34.74	38.77	4.78	58.63	63.41	5.19	68.45	73.64	5.65	85.07	90.72	30.72	110.43	141.15
1.00	60.00	2.59	17.63	20.22	3.38	24.74	28.12	4.33	30.90	35.23	5.08	48.90	53.98	5.49	57.23	62.72	15.15	73.51	88.66	31.92	95.81	127.73
1.08	65.00	2.70	15.89	18.59	3.55	22.20	25.75	4.58	28.16	32.74	5.33	42.78	48.11	6.30	50.23	56.53	29.72	66.37	96.09	34.49	86.66	121.15
1.17	70.00	2.79	13.63	16.42	3.70	19.91	23.61	4.81	25.58	30.39	5.55	36.41	41.96	14.94	42.84	57.78	30.21	55.34	85.55	53.73	72.60	126.33
1.25	75.00	2.87	11.46	14.33	3.84	17.10	20.94	5.01	23.01	28.02	6.25	30.66	36.91	24.32	36.16	60.48	30.53	44.97	75.50	68.71	59.42	128.13
1.33	80.00	2.93	9.51	12.44	3.97	14.14	18.11	5.18	19.48	24.66	12.33	24.76	37.09	29.87	29.17	59.04	30.79	34.93	65.72	73.88	46.13	120.01
1.42	85.00	2.99	7.93	10.92	4.09	11.69	15.78	5.32	15.58	20.90	19.28	19.60	38.88	30.07	23.03	53.10	31.01	26.23	57.24	72.67	34.55	107.22
1.50	90.00	3.05	6.97	10.02	4.20	10.29	14.49	5.44	13.16	18.60	25.17	14.82	39.99	30.25	17.32	47.57	31.20	19.11	50.31	68.71	25.36	94.07
1.58	95.00	3.10	6.50	9.60	4.30	9.58	13.88	5.55	11.74	17.29	29.61	11.96	41.57	30.41	13.95	44.36	31.37	14.90	46.27	64.29	19.87	84.16
1.67	100.00	3.15	6.27	9.42	4.40	8.56	12.96	5.64	10.76	16.40	29.92	10.21	40.13	30.56	11.85	42.41	31.53	12.39	43.92	60.59	16.55	77.14
1.75	105.00	3.20	6.14	9.34	4.48	7.72	12.20	6.07	10.05	16.12	30.03	9.08	39.11	30.69	10.48	41.17	31.67	10.63	42.30	57.81	14.20	72.01
1.83	110.00	3.24	6.04	9.28	4.55	7.11	11.66	8.15	9.57	17.72	30.13	8.29	38.42	30.82	9.52	40.34	31.81	9.43	41.24	55.69	12.60	68.29
1.92	115.00	3.28	5.34	8.62	4.62	6.67	11.29	10.36	8.98	19.34	30.22	7.79	38.01	30.93	8.90	39.83	31.94	8.58	40.52	54.06	11.45	65.51
2.00	120.00	3.32	4.68	8.00	4.67	6.16	10.83	12.00	8.10	20.10	30.31	7.44	37.75	31.04	8.45	39.49	32.05	7.98	40.03	52.58	10.64	63.22
2.08	125.00	3.35	3.59	6.94	4.71	4.72	9.43	12.85	6.16	19.01	30.35	5.71	36.06	31.13	6.47	37.60	32.15	6.02	38.17	51.05	8.02	59.07
2.17	130.00	3.37	2.65	6.02	4.75	3.44	8.19	13.03	4.45	17.48	30.34	4.14	34.48	31.20	4.68	35.88	32.24	4.36	36.60	49.59	5.80	55.39
2.25	135.00	3.39	1.95	5.34	4.77	2.52	7.29	12.75	3.22	15.97	30.26	3.01	33.27	31.26	3.40	34.66	32.32	3.19	35.51	48.23	4.22	52.45
2.33	140.00	3.41	1.42	4.83	4.79	1.83	6.62	12.18	2.34	14.52	30.12	2.20	32.32	31.31	2.48	33.79	32.38	2.35	34.73	46.99	3.11	50.10
2.42	145.00	3.43	1.02	4.45	4.80	1.28	6.08	11.47	1.67	13.14	29.95	1.56	31.51	31.35	1.75	33.10	32.44	1.68	34.12	45.87	2.22	48.09
2.50	150.00	3.44	0.71	4.15	4.81	0.88	5.69	10.72	1.17	11.89	28.62	1.10	29.72	31.39	1.23	32.62	32.49	1.18	33.67	44.86	1.56	46.42
2.58	155.00	3.46	0.49	3.95	4.81	0.61	5.42	10.00	0.82	10.82	23.64	0.79	24.43	31.37	0.88	32.25	32.54	0.84	33.38	43.95	1.11	45.06
2.67	160.00	3.47	0.31	3.78	4.82	0.41	5.23	9.36	0.53	9.89	19.85	0.52	20.37	31.27	0.59	31.86	32.58	0.56	33.14	43.11	0.74	43.85
2.75	165.00	3.48	0.17	3.65	4.82	0.24	5.06	8.83	0.31	9.14	16.93	0.32	17.25	31.13	0.35	31.48	32.61	0.34	32.95	42.34	0.44	42.78
2.83	170.00	3.50	0.08	3.58	4.83	0.12	4.95	8.39	0.15	8.54	14.67	0.16	14.83	30.96	0.18	31.14	32.64	0.17	32.81	41.64	0.22	41.86
2.92	175.00	3.51	0.03	3.54	4.83	0.04	4.87	8.03	0.05	8.08	12.93	0.05	12.98	30.76	0.06	30.82	32.66	0.06	32.72	40.98	0.07	41.05
3.00	180.00	3.52	0.00	3.52	4.84	0.00	4.84	7.72	0.00	7.72	11.61	0.00	11.61	30.54	0.00	30.54	32.67	0.00	32.67	40.37	0.00	40.37
3.08	185.00	3.53		3.53	4.84	0.00	4.84	7.47	0.00	7.47	10.59	0.00	10.59	30.31	0.00	30.31	32.62	0.00	32.62	39.78	0.00	39.78
3.17	190.00	3.54		3.54	4.85		4.85	7.25		7.25	9.79	0.00	9.79	30.07	0.00	30.07	32.51	0.00	32.51	39.21	0.00	39.21
3.25	195.00	3.55		3.55	4.85		4.85	7.06		7.06	9.15	0.00	9.15	29.82	0.00	29.82	32.37		32.37	38.66	0.00	38.66
3.33	200.00	3.56		3.56	4.86		4.86	6.90		6.90	8.63	0.00	8.63	23.98	0.00	23.98	32.19		32.19	38.13	0.00	38.13
3.42	205.00	3.57		3.57	4.86		4.86	6.76		6.76	8.21	0.00	8.21	19.59	0.00	19.59	31.99		31.99	37.60	0.00	37.60
3.50	210.00	3.58		3.58	4.86		4.86	6.63		6.63	7.86		7.86	16.49	0.00	16.49	31.78		31.78	37.04	0.00	37.04
3.58	215.00	3.59		3.59	4.87		4.87	6.52		6.52	7.57		7.57	14.25		14.25	31.55		31.55	35.80	0.00	35.80
3.67	220.00	3.59		3.59	4.87		4.87	6.42		6.42	7.32		7.32	12.58		12.58	31.31		31.31	33.93	0.00	33.93
3.75	225.00	3.60		3.60	4.87		4.87	6.32		6.32	7.11		7.11	11.31		11.31	31.07		31.07	32.74	0.00	32.74
3.83	230.00	3.61		3.61	4.88		4.88	6.24		6.24	6.92		6.92	10.33		10.33	30.82		30.82	32.57	0.00	32.57
3.92	235.00	3.61		3.61	4.88		4.88	6.17		6.17	6.76		6.76	9.56		9.56	30.57		30.57	32.38	0.00	32.38
4.00	240.00	3.62		3.62	4.88		4.88	6.10		6.10	6.62		6.62	8.94		8.94	30.32		30.32	32.17		32.17
4.08	245.00	3.63		3.63	4.88		4.88	6.04		6.04	6.50		6.50	8.44		8.44	30.07		30.07	31.94		31.94
4.17	250.00	3.63		3.63	4.88		4.88	5.98		5.98	6.39		6.39	8.03		8.03	29.77		29.77	31.71		31.71
4.25	255.00	3.64		3.64	4.88		4.88	5.93		5.93	6.29		6.29	7.69		7.69	23.75		23.75	31.47		31.47
4.33	260.00	3.64		3.64	4.89		4.89	5.88		5.88	6.21		6.21	7.41		7.41	19.39		19.39	31.22		31.22
4.42	265.00	3.65		3.65	4.89		4.89	5.84		5.84	6.13		6.13	7.17		7.17	16.31		16.31	30.98		30.98
4.50	270.00	3.65		3.65	4.89		4.89	5.80		5.80	6.05		6.05	6.96		6.96	14.07		14.07	30.73		30.73
4.58	275.00	3.65		3.65	4.89		4.89	5.76		5.76	5.99		5.99	6.78		6.78	12.41		12.41	30.48		30.48
4.67	280.00	3.66		3.66	4.89		4.89	5.74		5.74	5.93		5.93	6.63		6.63	11.14		11.14	30.22		30.22
4.75	285.00	3.66		3.66	4.89		4.89	5.71		5.71	5.88		5.88	6.49		6.49	10.17		10.17	29.97		29.97
4.83	290.00	3.66		3.66	4.89		4.89	5.70		5.70	5.83		5.83	6.37		6.37	9.40		9.40	27.51		27.51
4.92	295.00	3.67		3.67	4.89		4.89	5.69		5.69	5.79		5.79	6.27		6.27	8.78		8.78	21.96		21.96
5.00	300.00	3.67		3.67	4.89		4.89	5.69		5.69	5.75		5.75	6.17		6.17	8.29		8.29	18.12		18.12
5.08	305.00	3.67		3.67	4.89		4.89	5.69		5.69	5.73		5.73	6.09		6.09	7.88		7.88	15.38		15.38
5.17	310.00	3.67		3.67	4.89		4.89	5.68		5.68	5.70		5.70	6.01		6.01	7.54		7.54	13.38		13.38
5.25	315.00	3.67		3.67	4.89		4.89	5.68		5.68	5.69		5.69	5.94		5.94	7.26		7.26	11.87		11.87
5.33	320.00	3.67		3.67	4.89		4.89	5.68		5.68	5.69		5.69	5.88		5.88	7.02		7.02	10.72		10.72
5.42	325.00	3.67		3.67	4.88		4.88	5.67		5.67	5.69		5.69	5.83		5.83	6.81		6.81	9.83		9.83
5.50	330.00	3.67		3.67	4.88		4.88	5.67		5.67	5.68		5.68	5.78		5.78	6.64		6.64	9.12		9.12
5.58	335.00	3.67		3.67	4.88		4.88	5.66		5.66	5.68		5.68	5.75		5.75	6.48		6.48	8.55		8.55
5.67	340.00	3.67		3.67	4.88		4.88	5.66		5.66	5.68		5.68	5.72		5.72	6.35		6.35	8.09		8.09
5.75	345.00	3.67		3.67	4.88		4.88	5.65		5.65	5.67		5.67	5.70		5.70	6.23		6.23	7.71		7.71

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch

Basin ID: Pond C2.2



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.25	0.827	Orifice Plate
Zone 2 (EURV)	5.17	1.824	Rectangular Orifice
3 (100+1/2WQCV)	7.28	2.269	Weir&Pipe (Restrict)
Total (all zones)		4.920	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.25	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	13.00	inches
Orifice Plate: Orifice Area per Row =	2.21	sq. inches (diameter = 1-11/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.535E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.08	2.17					
Orifice Area (sq. inches)	2.21	2.21	2.21					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.25	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.17	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	6.00		inches

Calculated Parameters for Vertical Orifi

	Zone 2 Rectangular	Not Selected
Vertical Orifice Area =	0.25	N/A
Vertical Orifice Centroid =	0.25	N/A

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	7.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow We

	Zone 3 Weir	Not Selected
Height of Grate Upper Edge, H_t =	7.00	N/A
Overflow Weir Slope Length =	6.00	N/A
Grate Open Area / 100-yr Orifice Area =	10.58	N/A
Overflow Grate Open Area w/o Debris =	33.60	N/A
Overflow Grate Open Area w/ Debris =	16.80	N/A

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected
Outlet Orifice Area =	3.18	N/A
Outlet Orifice Centroid =	0.87	N/A
Half-Central Angle of Restrictor Plate on Pipe =	1.81	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	20.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.49	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.51	feet
Stage at Top of Freeboard =	13.00	feet
Basin Area at Top of Freeboard =	1.33	acres
Basin Volume at Top of Freeboard =	8.28	acre-ft

micropool = 0 = 5744.00

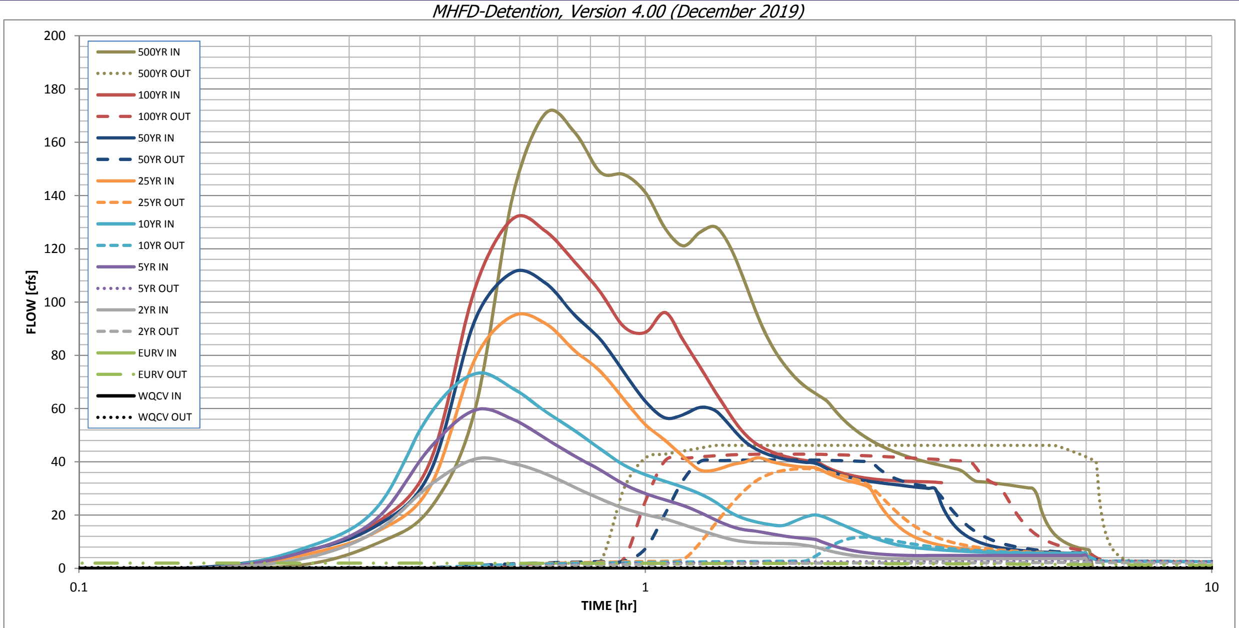
Routed Hydrograph Results

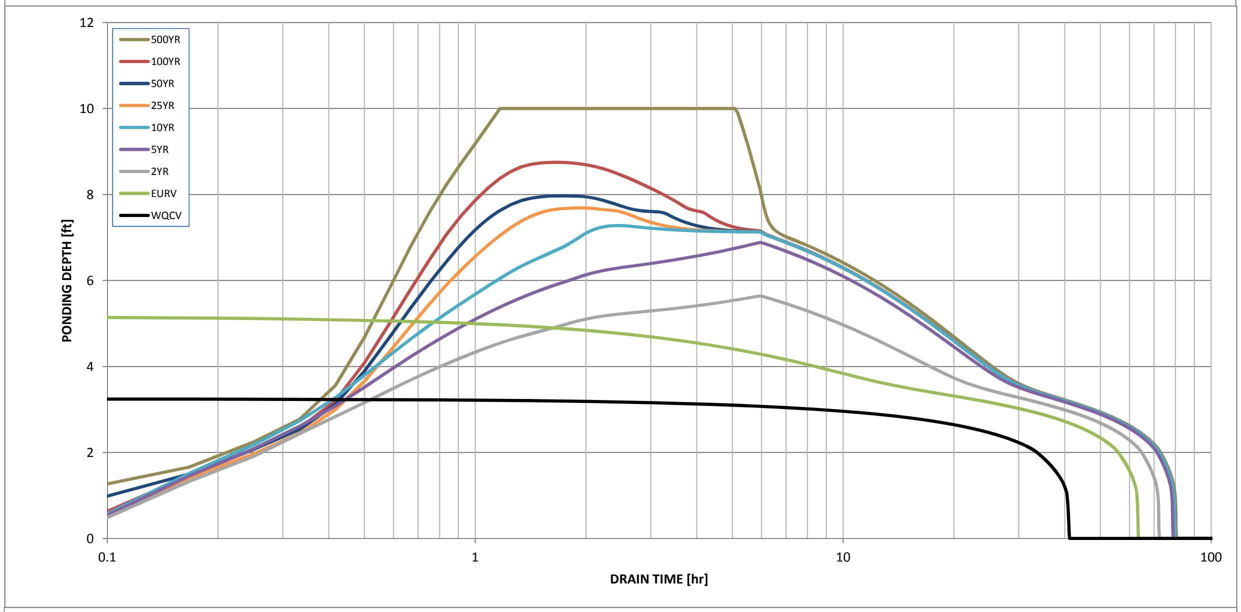
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

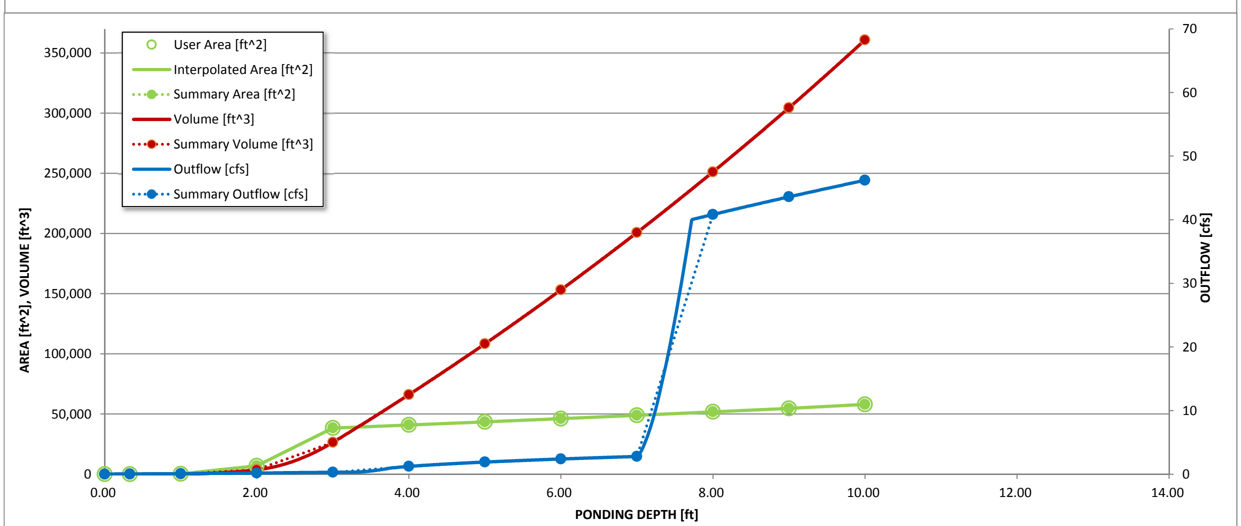
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.827	2.651	2.510	3.521	4.403	5.541	6.487	7.671
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.034	5.603	7.467	11.034	14.029	17.717
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	5.0	13.5	20.5	36.5	45.7	58.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.30	0.46	0.81	1.02	1.29
Peak Inflow Q (cfs) =	N/A	N/A	41.1	59.5	73.1	94.8	111.2	131.3
Peak Outflow Q (cfs) =	0.3	2.0	2.2	2.7	11.7	37.5	40.7	42.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.6	1.0	0.9	0.7
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.3	1.0	1.1	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	56	62	66	64	59	55	50
Time to Drain 99% of Inflow Volume (hours) =	**40**	61	68	73	73	71	69	67
Maximum Ponding Depth (ft) =	3.25	5.17	5.64	6.88	7.28	7.69	7.97	8.75
Area at Maximum Ponding Depth (acres) =	0.90	1.01	1.04	1.12	1.14	1.17	1.19	1.24
Maximum Volume Stored (acre-ft) =	0.829	2.658	3.139	4.475	4.916	5.390	5.720	6.666

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	USER	USER	USER	USER	USER	USER	USER
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.03
	0:05:00	0.00	0.00	0.03	0.03	0.03	0.03	0.04	0.03	0.04
	0:10:00	0.00	0.00	0.06	0.07	0.08	0.07	0.50	0.11	1.45
	0:15:00	0.00	0.00	3.84	6.22	7.68	5.19	6.48	6.30	9.13
	0:20:00	0.00	0.00	13.74	18.16	22.09	13.52	15.76	16.84	22.46
	0:25:00	0.00	0.00	31.28	45.27	58.06	30.69	36.11	40.02	59.40
	0:30:00	0.00	0.00	41.06	59.46	73.14	78.58	93.19	105.11	139.94
	0:35:00	0.00	0.00	39.47	55.99	67.61	94.83	111.22	131.32	170.94
	0:40:00	0.00	0.00	35.50	48.76	58.87	91.91	107.11	126.58	163.75
	0:45:00	0.00	0.00	30.44	42.21	51.76	81.75	95.10	115.09	148.71
	0:50:00	0.00	0.00	26.07	36.88	44.80	73.92	85.89	103.64	147.91
	0:55:00	0.00	0.00	22.55	31.62	38.77	63.41	73.64	90.72	141.15
	1:00:00	0.00	0.00	20.22	28.12	35.23	53.98	62.72	88.66	127.73
	1:05:00	0.00	0.00	18.59	25.75	32.74	48.11	56.53	96.09	121.15
	1:10:00	0.00	0.00	16.42	23.61	30.39	41.96	57.78	85.55	126.33
	1:15:00	0.00	0.00	14.33	20.94	28.02	36.91	60.48	75.50	128.13
	1:20:00	0.00	0.00	12.44	18.11	24.66	37.09	59.04	65.72	120.01
	1:25:00	0.00	0.00	10.92	15.78	20.90	38.88	53.10	57.24	107.22
	1:30:00	0.00	0.00	10.02	14.49	18.60	39.99	47.57	50.31	94.07
	1:35:00	0.00	0.00	9.60	13.88	17.29	41.57	44.36	46.27	84.16
	1:40:00	0.00	0.00	9.42	12.96	16.40	40.13	42.41	43.92	77.14
	1:45:00	0.00	0.00	9.34	12.20	16.12	39.11	41.17	42.30	72.01
	1:50:00	0.00	0.00	9.28	11.66	17.72	38.42	40.34	41.24	68.29
	1:55:00	0.00	0.00	8.62	11.29	19.34	38.01	39.83	40.52	65.51
	2:00:00	0.00	0.00	8.00	10.83	20.10	37.75	39.49	40.03	63.22
	2:05:00	0.00	0.00	6.94	9.43	19.01	36.06	37.60	38.17	59.07
	2:10:00	0.00	0.00	6.02	8.19	17.48	34.48	35.88	36.60	55.39
	2:15:00	0.00	0.00	5.34	7.29	15.97	33.27	34.66	35.51	52.45
	2:20:00	0.00	0.00	4.83	6.62	14.52	32.32	33.79	34.73	50.10
	2:25:00	0.00	0.00	4.45	6.08	13.14	31.51	33.10	34.12	48.09
	2:30:00	0.00	0.00	4.15	5.69	11.89	29.72	32.62	33.67	46.42
	2:35:00	0.00	0.00	3.95	5.42	10.82	24.43	32.25	33.38	45.06
	2:40:00	0.00	0.00	3.78	5.23	9.89	20.37	31.86	33.14	43.85
	2:45:00	0.00	0.00	3.65	5.06	9.14	17.25	31.48	32.95	42.78
	2:50:00	0.00	0.00	3.58	4.95	8.54	14.83	31.14	32.81	41.86
	2:55:00	0.00	0.00	3.54	4.87	8.08	12.98	30.82	32.72	41.05
	3:00:00	0.00	0.00	3.52	4.84	7.72	11.61	30.54	32.67	40.37
	3:05:00	0.00	0.00	3.53	4.84	7.47	10.59	30.31	32.62	39.78
	3:10:00	0.00	0.00	3.54	4.85	7.25	9.79	30.07	32.51	39.21
	3:15:00	0.00	0.00	3.55	4.85	7.06	9.15	29.82	32.37	38.66
	3:20:00	0.00	0.00	3.56	4.86	6.90	8.63	23.98	32.19	38.13
	3:25:00	0.00	0.00	3.57	4.86	6.76	8.21	19.59	31.99	37.60
	3:30:00	0.00	0.00	3.58	4.86	6.63	7.86	16.49	31.78	37.04
	3:35:00	0.00	0.00	3.59	4.87	6.52	7.57	14.25	31.55	35.80
	3:40:00	0.00	0.00	3.59	4.87	6.42	7.32	12.58	31.31	33.93
	3:45:00	0.00	0.00	3.60	4.87	6.32	7.11	11.31	31.07	32.74
	3:50:00	0.00	0.00	3.61	4.88	6.24	6.92	10.33	30.82	32.57
	3:55:00	0.00	0.00	3.61	4.88	6.17	6.76	9.56	30.57	32.38
	4:00:00	0.00	0.00	3.62	4.88	6.10	6.62	8.94	30.32	32.17
	4:05:00	0.00	0.00	3.63	4.88	6.04	6.50	8.44	30.07	31.94
	4:10:00	0.00	0.00	3.63	4.88	5.98	6.39	8.03	29.77	31.71
	4:15:00	0.00	0.00	3.64	4.88	5.93	6.29	7.69	23.75	31.47
	4:20:00	0.00	0.00	3.64	4.89	5.88	6.21	7.41	19.39	31.22
	4:25:00	0.00	0.00	3.65	4.89	5.84	6.13	7.17	16.31	30.98
	4:30:00	0.00	0.00	3.65	4.89	5.80	6.05	6.96	14.07	30.73
	4:35:00	0.00	0.00	3.65	4.89	5.76	5.99	6.78	12.41	30.48
	4:40:00	0.00	0.00	3.66	4.89	5.74	5.93	6.63	11.14	30.22
	4:45:00	0.00	0.00	3.66	4.89	5.71	5.88	6.49	10.17	29.97
	4:50:00	0.00	0.00	3.66	4.89	5.70	5.83	6.37	9.40	27.51
	4:55:00	0.00	0.00	3.67	4.89	5.69	5.79	6.27	8.78	21.96
	5:00:00	0.00	0.00	3.67	4.89	5.69	5.75	6.17	8.29	18.12
	5:05:00	0.00	0.00	3.67	4.89	5.69	5.73	6.09	7.88	15.38
	5:10:00	0.00	0.00	3.67	4.89	5.68	5.70	6.01	7.54	13.38
	5:15:00	0.00	0.00	3.67	4.89	5.68	5.69	5.94	7.26	11.87
	5:20:00	0.00	0.00	3.67	4.89	5.68	5.69	5.88	7.02	10.72
	5:25:00	0.00	0.00	3.67	4.88	5.67	5.69	5.83	6.81	9.83
	5:30:00	0.00	0.00	3.67	4.88	5.67	5.68	5.78	6.64	9.12
	5:35:00	0.00	0.00	3.67	4.88	5.66	5.68	5.75	6.48	8.55
	5:40:00	0.00	0.00	3.67	4.88	5.66	5.68	5.72	6.35	8.09
	5:45:00	0.00	0.00	3.67	4.88	5.65	5.67	5.70	6.23	7.71
	5:50:00	0.00	0.00	3.67	4.87	5.65	5.67	5.69	6.13	7.39
	5:55:00	0.00	0.00	3.67	4.87	5.64	5.66	5.69	6.04	7.13
	6:00:00	0.00	0.00	3.65	4.86	5.63	5.65	5.68	5.81	6.62

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft ^{2}]	Area [acres]	Volume [ft ^{3}]	Volume [ac-ft]	Total Outflow [cfs]
micropool	0.00	40	0.001	0	0.000	0.00
surcharge	0.33	50	0.001	15	0.000	0.04
5745	1.00	255	0.006	117	0.003	0.07
5746	2.00	6,998	0.161	3,743	0.086	0.18
5747	3.00	38,392	0.881	26,438	0.607	0.30
5748	4.00	40,927	0.940	66,098	1.517	1.23
5749	5.00	43,534	0.999	108,328	2.487	1.91
5750	6.00	46,212	1.061	153,201	3.517	2.39
5751	7.00	48,991	1.125	200,803	4.610	2.79
5752	8.00	51,837	1.190	251,217	5.767	40.84
5753	9.00	54,731	1.256	304,501	6.990	43.61
5754	10.00	58,033	1.332	360,883	8.285	46.21

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**May 2, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C2.2**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 55.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.550

C) Contributing Watershed Area — Area = 45.000 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- (●) Water Quality Capture Volume (WQCV)
- ( ) Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$) — V_{DESIGN}= 0.827 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$ — $V_{DESIGN\ OTHER}$= ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$= ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = %

J) Excess Urban Runoff Volume (EURV) Design Volume — $EURV_{DESIGN}$ = ac-f t
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$= ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 3.00 ft / ft

DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.025 ac-ft

B) Actual Forebay Volume — V_F = 0.028 ac-ft

C) Forebay Depth (D_F = 30 inch maximum) — D_F = 24.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 131.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 2.62 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = in

G) Rectangular Notch Width — Calculated W_N = 8.1 in

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6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 50 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 1.48 inches
E) Total Outlet Area	A_{ot} = 6.63 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 108 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 16.7 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 222 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): y	*Other (Please describe below)* wellscreen stainless
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio = 0.6
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 370 sq. in. **Based on type 'Other' screen ratio**
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 3.25 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 67 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Channel Report

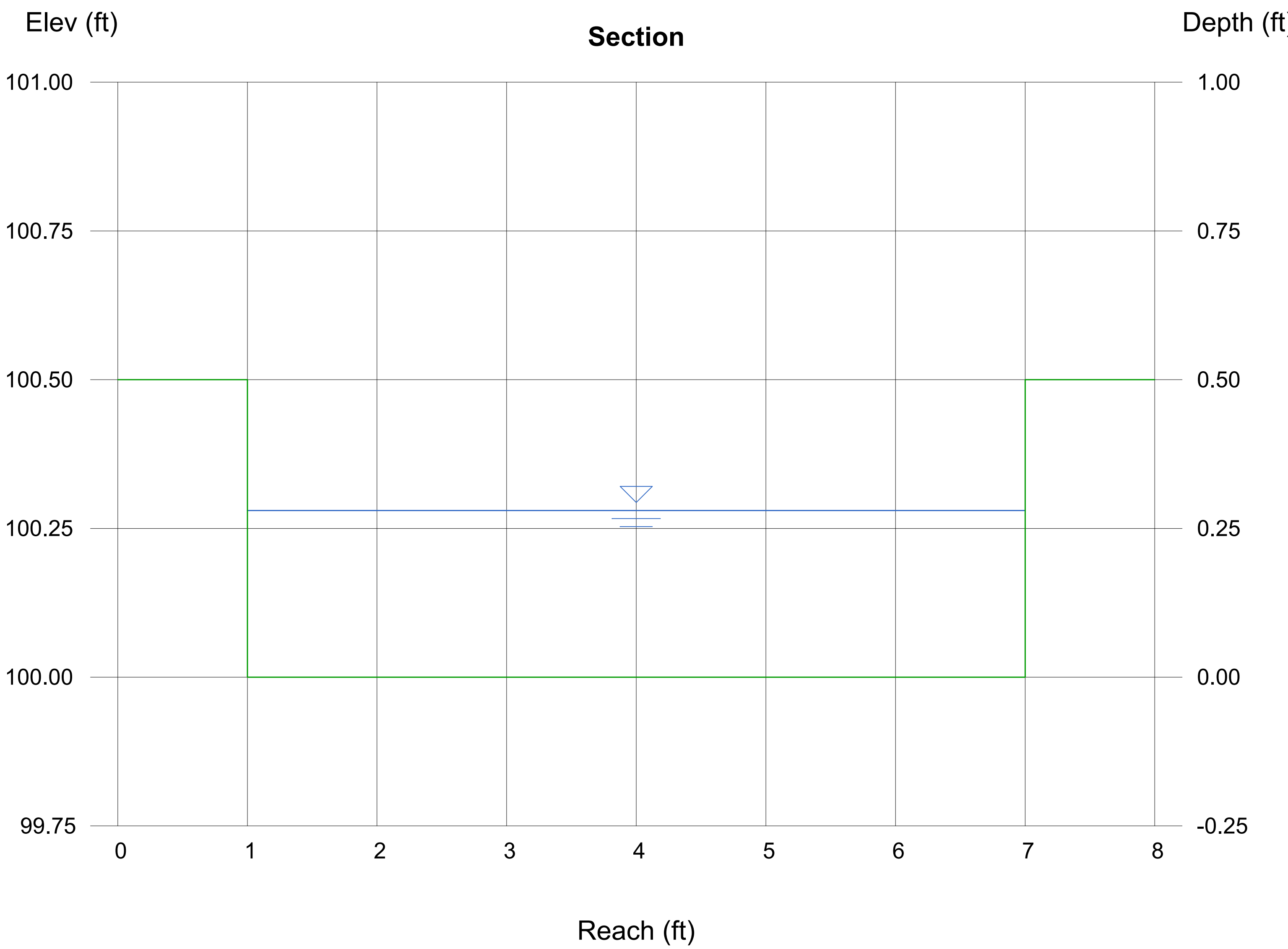
pond C2.2 low flow channel (2 x forebay release = 5.24cfs)

Rectangular
Botom Width (ft) = 6.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 5.24

Highlighted
Depth (ft) = 0.28
Q (cfs) = 5.240
Area (sqft) = 1.68
Velocity (ft/s) = 3.12
Wetted Perim (ft) = 6.56
Crit Depth, Yc (ft) = 0.29
Top Width (ft) = 6.00
EGL (ft) = 0.43



Weir Report

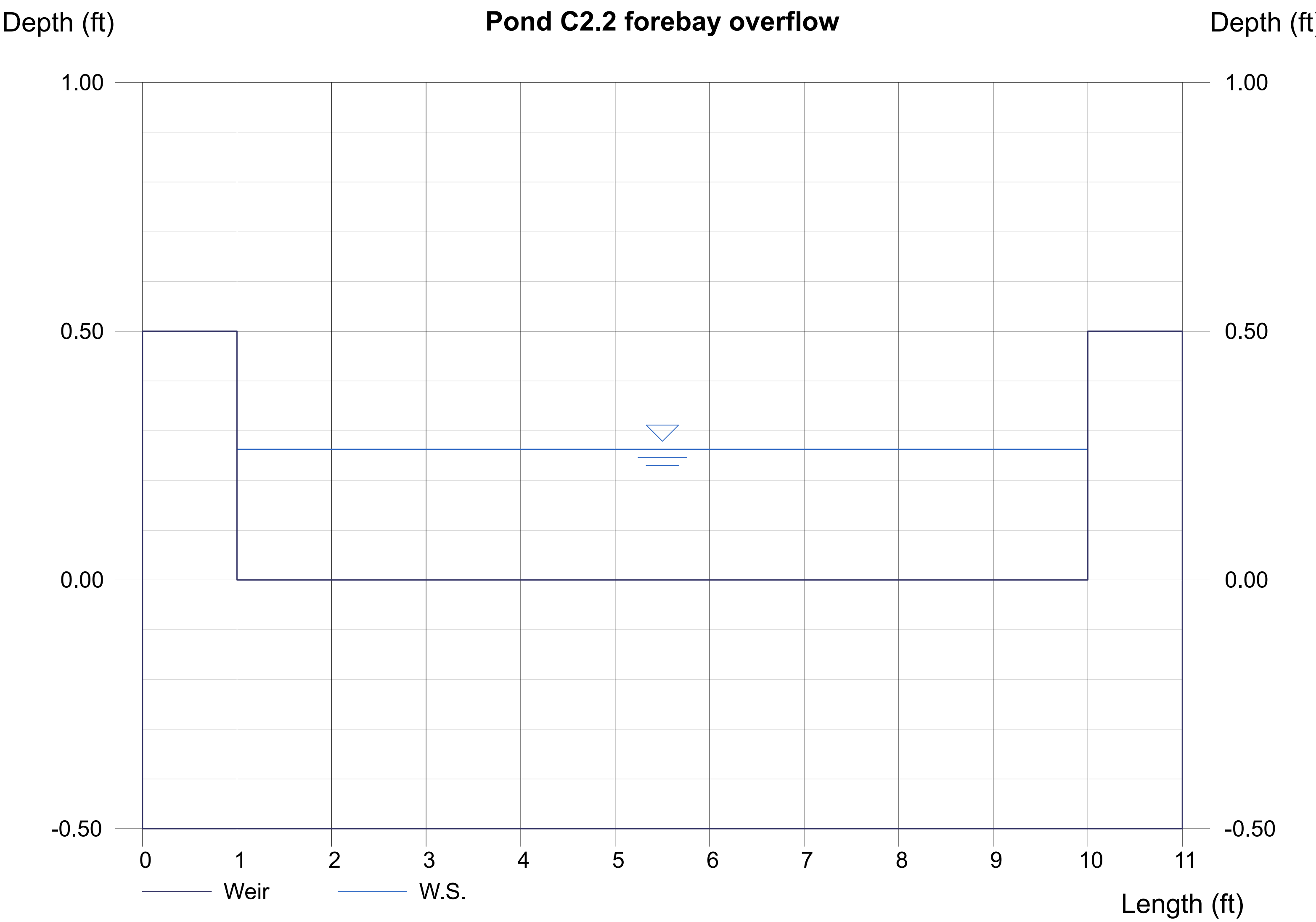
Hydraflow Express by Intelisolve | Saturday, May 2 2020, 9:19 AM

Pond C2.2 forebay overflow

Rectangular Weir
Crest = Sharp
Bottom Length (ft) = 9.00
Total Depth (ft) = 0.50

Calculations
Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 4.04

Highlighted
Depth (ft) = 0.26
Q (cfs) = 4.040
Area (sqft) = 2.36
Velocity (ft/s) = 1.71
Top Width (ft) = 9.00

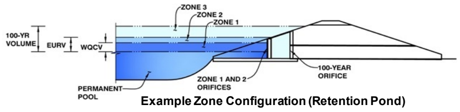


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: **The Hills at Lorson Ranch**

Basin ID: **Pond C2.3**



Example Zone Configuration (Retention Pond)

micropool = 0 = 5744.17

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	16.00	acres		
Watershed Length =	1,700	ft		
Watershed Length to Centroid =	800	ft		
Watershed Slope =	0.030	ft/ft		
Watershed Imperviousness =	55.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	40.0%	percent		
Percentage Hydrologic Soil Groups C/D =	60.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.294	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.883	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.924	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.299	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.627	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.016	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.357	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.775	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.648	acre-feet		inches
Approximate 2-yr Detention Volume =	0.736	acre-feet		
Approximate 5-yr Detention Volume =	1.046	acre-feet		
Approximate 10-yr Detention Volume =	1.257	acre-feet		
Approximate 25-yr Detention Volume =	1.358	acre-feet		
Approximate 50-yr Detention Volume =	1.409	acre-feet		
Approximate 100-yr Detention Volume =	1.570	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.294	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.589	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.834	acre-feet
Total Detention Basin Volume =	1.717	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.20 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
5744.5	--	0.33	--	--	--	50	0.001	15	0.000
5745	--	0.83	--	--	--	412	0.009	130	0.003
5746	--	1.83	--	--	--	9,243	0.212	4,958	0.114
5747	--	2.83	--	--	--	25,797	0.592	22,478	0.516
5748	--	3.83	--	--	--	28,015	0.643	49,384	1.134
5749	--	4.83	--	--	--	30,331	0.696	78,557	1.803
5750	--	5.83	--	--	--	32,748	0.752	110,096	2.527
5751	--	6.83	--	--	--	35,264	0.810	144,102	3.308
5752	--	7.83	--	--	--	37,880	0.870	180,674	4.148
5753	--	8.83	--	--	--	40,817	0.937	220,023	5.051
5754	--	9.83	--	--	--	44,000	1.010	262,431	6.025
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Pond C2.3 Developed Inflow Hydrograph---- Pond C2.1 outflow + C3 Basin + C4 Basin

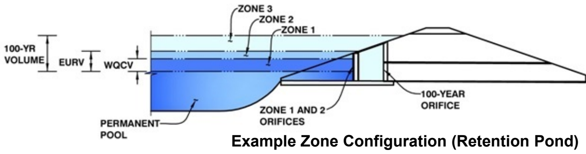
		2 Year	CUHP	2yr Combined	5 Year	CUHP	5yr Combined	10 Year	CUHP	10yr Combined	25 Year	CUHP	25yr Combined	50 Year	CUHP	50yr Combined	100 Year	CUHP	100yr Combined	500 Year	CUHP	500yr Combined
Time [hr]	Time [min]	Ponc C2.1 Outflow2 - [cfs]	2 Year [cfs]	Hydrograph	Ponc C2.1 Outflow2 - [cfs]	5 Year [cfs]	Hydrograph	Ponc C2.1 Outflow2 - [cfs]	10 Year [cfs]	Hydrograph	Ponc C2.1 Outflow2 - [cfs]	25 Year [cfs]	Hydrograph	Ponc C2.1 Outflow2 - [cfs]	50 Year [cfs]	Hydrograph	Ponc C2.1 Outflow2 - [cfs]	100 Year [cfs]	Hydrograph	Ponc C2.1 Outflow2 - [cfs]	500 Year [cfs]	Hydrograph
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.08	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10	0.04	0.00	0.04	0.12	0.00	0.12
0.17	10.00	0.14	0.00	0.14	0.19	0.00	0.19	0.20	0.00	0.20	0.18	0.00	0.18	0.20	0.13	0.33	0.19	0.01	0.21	0.23	0.43	0.65
0.25	15.00	0.26	1.17	1.43	0.28	1.91	2.19	0.29	2.37	2.66	0.27	1.59	1.86	0.28	1.99	2.27	0.28	1.94	2.22	0.30	2.80	3.10
0.33	20.00	0.33	4.21	4.55	0.40	5.61	6.01	0.45	6.91	7.36	0.34	4.12	4.46	0.35	4.81	5.16	0.38	5.14	5.52	0.46	7.03	7.49
0.42	25.00	0.48	9.83	10.31	0.54	14.69	15.23	0.58	18.61	19.20	0.52	9.65	10.17	0.55	11.51	12.06	0.57	12.82	13.39	1.01	18.71	19.72
0.50	30.00	0.56	13.28	13.84	1.04	18.82	19.86	2.46	22.84	25.30	1.63	24.57	26.19	2.69	28.96	31.65	3.20	32.54	35.73	4.38	43.29	47.67
0.58	35.00	0.82	12.88	13.71	2.85	17.81	20.66	3.68	21.42	25.10	3.81	29.19	33.00	4.42	34.09	38.51	4.92	40.16	45.09	21.56	52.46	74.02
0.67	40.00	2.15	11.77	13.92	3.65	15.99	19.64	4.41	19.25	23.66	4.87	28.83	33.70	5.47	33.53	39.00	22.18	39.47	61.65	60.08	51.34	111.42
0.75	45.00	2.84	10.24	13.08	4.18	14.14	18.32	4.93	17.24	22.17	6.06	26.34	32.41	33.77	30.62	64.39	58.30	36.96	95.25	63.77	47.98	111.74
0.83	50.00	3.28	8.93	12.21	4.57	12.65	17.22	5.32	15.26	20.58	29.98	24.16	54.14	57.77	28.08	85.85	60.60	33.83	94.43	66.54	43.91	110.45
0.92	55.00	3.59	7.84	11.43	4.87	11.06	15.92	6.22	13.49	19.72	51.01	21.27	72.28	59.00	24.75	83.75	62.28	30.40	92.68	83.88	39.47	123.35
1.00	60.00	3.84	6.88	10.72	5.10	9.62	14.72	14.35	11.94	26.29	57.40	18.58	75.98	59.80	21.64	81.44	63.51	27.30	90.81	107.73	35.43	143.17
1.08	65.00	4.04	6.17	10.20	5.30	8.60	13.89	22.57	10.89	33.46	57.66	16.29	73.95	60.27	19.00	79.26	64.36	24.59	88.95	118.61	31.98	150.59
1.17	70.00	4.19	5.44	9.64	5.46	7.90	13.36	28.29	10.19	38.48	57.67	14.12	71.79	60.45	16.54	76.99	64.83	20.97	85.80	116.88	27.41	144.29
1.25	75.00	4.31	4.83	9.14	5.79	7.15	12.94	31.11	9.58	40.69	57.45	12.44	69.89	60.39	14.62	75.01	64.95	18.02	82.97	107.79	23.67	131.46
1.33	80.00	4.40	4.29	8.70	8.07	6.33	14.39	31.24	8.56	39.80	55.45	10.74	66.19	60.08	12.61	72.69	64.77	15.09	79.86	95.59	19.81	115.41
1.42	85.00	4.48	3.78	8.25	10.19	5.55	15.74	29.51	7.32	36.84	46.93	9.19	56.12	59.55	10.77	70.32	64.32	12.49	76.81	83.32	16.38	99.70
1.50	90.00	4.53	3.29	7.82	11.64	4.82	16.46	27.10	6.18	33.28	39.29	7.64	46.93	58.81	8.94	67.75	63.64	10.21	73.85	73.03	13.37	86.40
1.58	95.00	4.58	2.84	7.42	12.48	4.18	16.66	24.75	5.20	29.95	32.90	6.21	39.11	57.92	7.26	65.18	62.81	8.15	70.96	67.05	10.66	77.71
1.67	100.00	4.62	2.49	7.12	12.80	3.49	16.28	22.71	4.46	27.17	27.91	4.97	32.88	54.45	5.81	60.26	61.88	6.37	68.25	66.27	8.35	74.62
1.75	105.00	4.66	2.31	6.97	12.76	3.04	15.80	20.99	4.04	25.03	24.09	4.05	28.14	41.15	4.74	45.90	60.87	5.07	65.94	65.42	6.70	72.12
1.83	110.00	4.70	2.22	6.92	12.52	2.77	15.29	19.53	3.77	23.30	21.17	3.51	24.68	32.72	4.11	36.83	59.81	4.28	64.09	64.51	5.68	70.19
1.92	115.00	4.73	1.98	6.71	12.17	2.57	14.74	18.20	3.51	21.70	18.94	3.16	22.10	27.12	3.71	30.83	58.70	3.77	62.47	63.55	5.01	68.56
2.00	120.00	4.75	1.77	6.51	11.57	2.37	13.94	16.69	3.18	19.86	16.96	2.93	19.89	22.93	3.43	26.36	57.53	3.39	60.92	62.52	4.53	67.05
2.08	125.00	4.75	1.41	6.16	10.67	1.88	12.55	14.90	2.52	17.42	14.92	2.30	17.22	19.31	2.69	22.01	45.28	2.61	47.89	61.40	3.49	64.88
2.17	130.00	4.75	1.09	5.84	9.62	1.45	11.08	13.04	1.95	14.98	12.94	1.76	14.69	16.19	2.06	18.24	32.26	1.94	34.21	60.18	2.60	62.77
2.25	135.00	4.73	0.85	5.58	8.59	1.13	9.72	11.30	1.50	12.80	11.16	1.34	12.50	13.58	1.57	15.15	23.92	1.45	25.37	58.88	1.93	60.81
2.33	140.00	4.72	0.65	5.37	7.65	0.86	8.52	9.77	1.13	10.91	9.63	1.02	10.64	11.44	1.19	12.62	18.31	1.08	19.40	57.52	1.45	58.97
2.42	145.00	4.69	0.50	5.20	6.84	0.66	7.49	8.48	0.85	9.33	8.34	0.77	9.11	9.70	0.90	10.60	14.39	0.82	15.22	43.18	1.10	44.28
2.50	150.00	4.67	0.38	5.05	6.18	0.49	6.67	7.42	0.63	8.05	7.30	0.57	7.87	8.31	0.67	8.98	11.58	0.62	12.20	29.70	0.82	30.53
2.58	155.00	4.64	0.29	4.93	5.72	0.36	6.08	6.58	0.47	7.05	6.48	0.43	6.91	7.22	0.50	7.72	9.52	0.46	9.99	21.43	0.62	22.05
2.67	160.00	4.61	0.21	4.82	5.56	0.26	5.82	5.95	0.35	6.30	5.89	0.32	6.21	6.39	0.37	6.77	8.00	0.35	8.36	16.08	0.47	16.54
2.75	165.00	4.58	0.15	4.73	5.53	0.19	5.72	5.58	0.26	5.84	5.57	0.24	5.80	5.81	0.28	6.09	6.89	0.26	7.14	12.46	0.34	12.80
2.83	170.00	4.54	0.10	4.65	5.50	0.13	5.62	5.54	0.18	5.72	5.54	0.17	5.70	5.56	0.19	5.75	6.09	0.18	6.27	9.94	0.24	10.18
2.92	175.00	4.51	0.06	4.57	5.46	0.08	5.55	5.51	0.11	5.62	5.50	0.11	5.61	5.53	0.12	5.65	5.62	0.12	5.74	8.17	0.15	8.32
3.00	180.00	4.48	0.03	4.51	5.43	0.05	5.48	5.48	0.06	5.54	5.47	0.06	5.53	5.50	0.07	5.57	5.54	0.07	5.61	6.92	0.09	7.01
3.08	185.00	4.44	0.01	4.45	5.40	0.02	5.42	5.44	0.03	5.47	5.44	0.03	5.47	5.46	0.03	5.50	5.51	0.03	5.54	6.08	0.04	6.12
3.17	190.00	4.41	0.00	4.41	5.37	0.01	5.37	5.41	0.01	5.42	5.41	0.01	5.42	5.43	0.01	5.44	5.48	0.01	5.49	5.61	0.01	5.62
3.25	195.00	4.37	0.00	4.37	5.33	0.00	5.33	5.38	0.00	5.38	5.38	0.00	5.38	5.40	0.00	5.40	5.45	0.00	5.45	5.54	0.00	5.54
3.33	200.00	4.34	0.00	4.34	5.30	0.00	5.30	5.35	0.00	5.35	5.34	0.00	5.34	5.37	0.00	5.37	5.41	0.00	5.41	5.51	0.00	5.51
3.42	205.00	4.30	0.00	4.30	5.27	0.00	5.27	5.31	0.00	5.31	5.31	0.00	5.31	5.33	0.00	5.33	5.38	0.00	5.38	5.48	0.00	5.48
3.50	210.00	4.26	0.00	4.26	5.23	0.00	5.23	5.28	0.00	5.28	5.28	0.00	5.28	5.30	0.00	5.30	5.35	0.00	5.35	5.44	0.00	5.44
3.58	215.00	4.23	0.00	4.23	5.20	0.00	5.20	5.25	0.00	5.25	5.24	0.00	5.24	5.27	0.00	5.27	5.32	0.00	5.32	5.41	0.00	5.41
3.67	220.00	4.19	0.00	4.19	5.17	0.00	5.17	5.21	0.00	5.21	5.21	0.00	5.21	5.24	0.00	5.24	5.28	0.00	5.28	5.38	0.00	5.38
3.75	225.00	4.16	0.00	4.16	5.14	0.00	5.14	5.18	0.00	5.18	5.18	0.00	5.18	5.20	0.00	5.20	5.25	0.00	5.25	5.35	0.00	5.35
3.83	230.00	4.12	0.00	4.12	5.10	0.00	5.10	5.15	0.00	5.15	5.14	0.00	5.14	5.17	0.00	5.17	5.22	0.00	5.22	5.31	0.00	5.31
3.92	235.00	4.09	0.00	4.09	5.07	0.00	5.07	5.11	0.00	5.11	5.11	0.00	5.11	5.14	0.00	5.14	5.18	0.00	5.18	5.28	0.00	5.28
4.00	240.00	4.05	0.00	4.05	5.04	0.00	5.04	5.08	0.00	5.08	5.08	0.00	5.08	5.10	0.00	5.10	5.15	0.00	5.15	5.25	0.00	5.25
4.08	245.00	4.01	0.00	4.01	5.00	0.00	5.00	5.05	0.00	5.05	5.04	0.00	5.04	5.07	0.00	5.07	5.12	0.00	5.12	5.22	0.00	5.22
4.17	250.00	3.98	0.00	3.98	4.97	0.00	4.97	5.01	0.00	5.01	5.01	0.00	5.01	5.04	0.00	5.04	5.08	0.00	5.08	5.18	0.00	5.18
4.25	255.00	3.94	0.00	3.94	4.93	0.00	4.93	4.98	0.00	4.98	4.98	0.00	4.98	5.00	0.00	5.00	5.05	0.00	5.05	5.15	0.00	5.15
4.33	260.00	3.91	0.00	3.91	4.90	0.00	4.90	4.95	0.00	4.95	4.94	0.00	4.94	4.97	0.00	4.97	5.02	0.00	5.02	5.12	0.00	5.12
4.42	265.00	3.87	0.00	3.87	4.87	0.00	4.87	4.91	0.00	4.91	4.91	0.00	4.91	4.94	0.00	4.94	4.98	0.00	4.98	5.08	0.00	5.08
4.50	270.00	3.83	0.00	3.83	4.83	0.00	4.83	4.88	0.00	4.88	4.88	0.00	4.88	4.90	0.00	4.90	4.95	0.00	4.95	5.05	0.00	5.05
4.58	275.00	3.80	0.00	3.80	4.80	0.00	4.80	4.85	0.00	4.85	4.84	0.00	4.84	4.87	0.00	4.87	4.92	0.00	4.92	5.02	0.00	5.02
4.67	280.00	3.76	0.00	3.76	4.76	0.00	4.76	4.81	0.00	4.81	4.81	0.00	4.81	4.83	0.00	4.83	4.88	0.00	4.88	4.98	0.00	4.98
4.75	285.00	3.72	0.00	3.72	4.73	0.00	4.73	4.78	0.00	4.78	4.77	0.00	4.77	4.80	0.00	4.80	4.85	0.00	4.85	4.95	0.00	4.95
4.83	290.00	3.69	0.00	3.69	4.70	0.00	4.70	4.74	0.00	4.74	4.74	0.00	4.74	4.77	0.00	4.77	4.81	0.00	4.81	4.91	0.00	4.91
4.92	295.00	3.65	0.00	3.65	4.66	0.00	4.66	4.71	0.00	4.71	4.71	0.00	4.71	4.73	0.00	4.73	4.78	0.00	4.78	4.88	0.00	4.88
5.00	300.00	3.61	0.00	3.61	4.63	0.00	4.63	4.67	0.00	4.67	4.67	0.00	4.67	4.70	0.00	4.70	4.75	0.00	4.75	4.85	0.00	4.85
5.08	305.00	3.57	0.00	3.57	4.59	0.00	4.59	4.64	0.00	4.64	4.64	0.00	4.64	4.66	0.00	4.66	4.71	0.00	4.71	4.81	0.00	4.81
5.17	310.00	3.54	0.00	3.54	4.56	0.00	4.56	4.61	0.00	4.61	4.60	0.00	4.60	4.63	0.00	4.63	4.68	0.00	4.68	4.78	0.00	4.78
5.25	315.00	3.50	0.00	3.50	4.52	0.00	4.52	4.57	0.00	4.57	4.57	0.00	4.57	4.59	0.00	4.59	4.64	0.00	4.64	4.74	0.00	4.74
5.33	320.00	3.46	0.00	3.46	4.49	0.00	4.49	4.54	0.00	4.54	4.53	0.00	4.53	4.56	0.00	4.56	4.61	0.00	4.61	4.71	0.00	4.71
5.42	325.00	3.42	0.00	3.42	4.45	0.00	4.45	4.50	0.00	4.50	4.50	0.00	4.50	4.52	0.00	4.52	4.57	0.00	4.57	4.68	0.00	4.68
5.50	330.00	3.39	0.00	3.39	4.42	0.00	4.42	4.47	0.00	4.47	4.46	0.00	4.46	4.49	0.00	4.49	4.54	0.00	4.54	4.64	0.00	4.64
5.58	335.00	3.35	0.00	3.35	4.38	0.00	4.38	4.43	0.00	4.43	4.43	0.00	4.43	4.45	0.00	4.45	4.50	0.00	4.50	4.61	0.00	4.61
5.67	340.00	3.31	0.00	3.31	4.35	0.00	4.35	4.40	0.00	4.40	4.39	0.00	4.39	4.42	0.00	4.42	4.47	0.00	4.47	4.57	0.00	4.57
5.75	345.00	3.27	0.00	3.27	4.31	0.00	4.31	4.36	0.00	4.36	4.36	0.00	4.36	4.38	0.00	4.38	4.43	0.00	4.43	4.54	0.00	4.54
5.83	350.00	3.23	0.00	3.23	4.28	0.00	4.28	4.33	0.00	4.33	4.32	0.00	4.32	4.35	0.00	4.35	4.40	0.00	4.40	4.50	0.00	4.50
5.92	355.00	3.20	0.00	3.20	4.24	0.00	4.24	4.29	0.00	4.29	4.29	0.00	4.29	4.31	0.00	4.31	4.36	0.00	4.36	4.47	0.00	4.47
6.00	360.00	3.16	0.00	3.16	4.21	0.00	4.21	4.26	0.00	4.26	4.25	0.00	4.25	4.28	0.00	4.28	4.33	0.00	4.33	4.43	0.00	4.43

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch

Basin ID: Pond C2.3



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.40	0.294	Orifice Plate
Zone 2 (EURV)	3.44	0.589	Rectangular Orifice
3 (100+1/2WQCV)	4.71	0.834	Weir&Pipe (Restrict)
Total (all zones)		1.717	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.44	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.80	inches
Orifice Plate: Orifice Area per Row =	0.98	sq. inches (diameter = 1-1/8 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	6.806E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.81	1.63					
Orifice Area (sq. inches)	0.98	0.98	0.98					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.44	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.64	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	17.00		inches

Calculated Parameters for Vertical Orifi

	Zone 2 Rectangular	Not Selected
Vertical Orifice Area =	0.71	N/A
Vertical Orifice Centroid =	0.25	N/A

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	7.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow We

	Zone 3 Weir	Not Selected
Height of Grate Upper Edge, H_t =	7.50	N/A
Overflow Weir Slope Length =	6.00	N/A
Grate Open Area / 100-yr Orifice Area =	6.84	N/A
Overflow Grate Open Area w/o Debris =	33.60	N/A
Overflow Grate Open Area w/ Debris =	16.80	N/A

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	30.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected
Outlet Orifice Area =	4.91	N/A
Outlet Orifice Centroid =	1.25	N/A
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.33	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	20.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.33	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.17	feet
Stage at Top of Freeboard =	11.83	feet
Basin Area at Top of Freeboard =	1.01	acres
Basin Volume at Top of Freeboard =	6.02	acre-ft

micropool = 0 = 5744.17

Routed Hydrograph Results

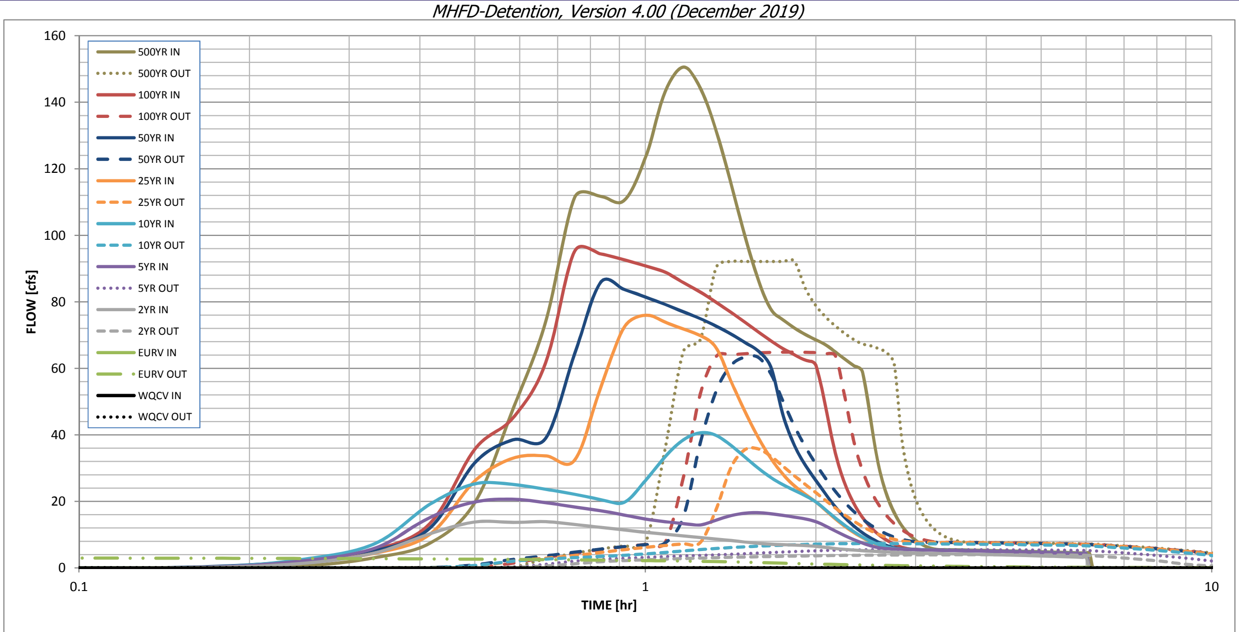
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

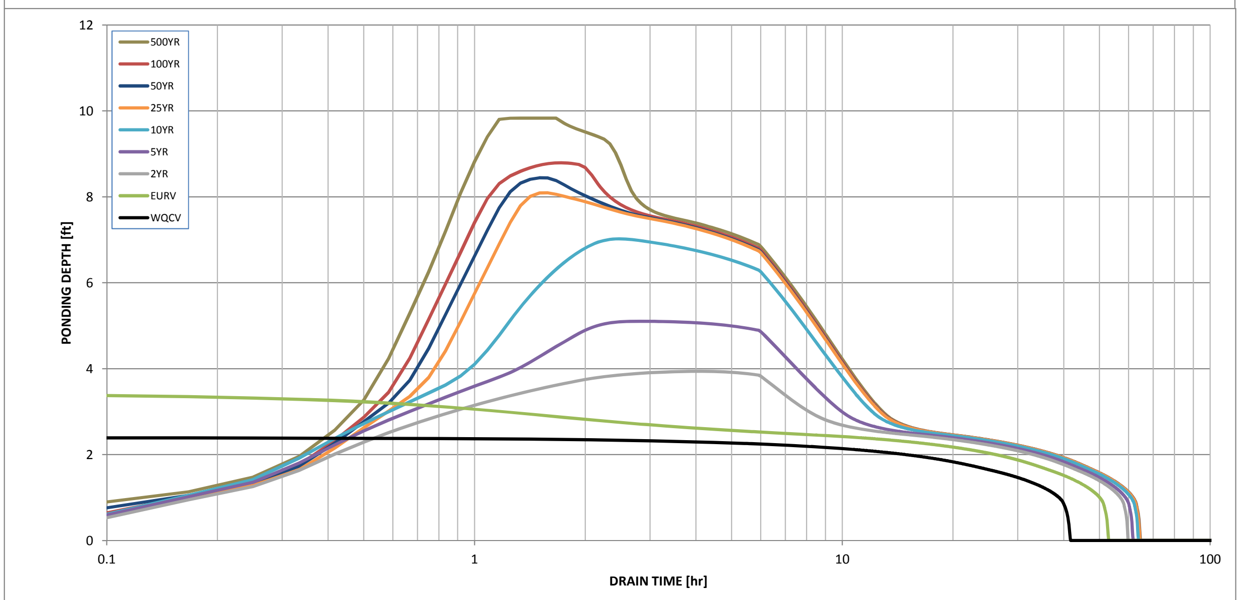
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.294	0.883	0.924	1.299	1.627	2.016	2.357	2.775
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.750	4.084	5.828	8.117	10.005	12.347
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.2	5.0	7.2	11.8	14.6	18.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.14	0.31	0.45	0.74	0.91	1.16
Peak Inflow Q (cfs) =	N/A	N/A	13.9	20.7	40.7	76.0	85.9	95.3
Peak Outflow Q (cfs) =	0.1	3.1	4.0	5.5	7.3	35.8	63.4	64.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	1.0	3.0	4.3	3.5
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.8	1.6	1.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	46	43	39	35	28	22	17
Time to Drain 99% of Inflow Volume (hours) =	**40**	50	53	52	51	48	45	42
Maximum Ponding Depth (ft) =	2.40	3.44	3.94	5.10	7.02	8.09	8.44	8.79
Area at Maximum Ponding Depth (acres) =	0.43	0.62	0.65	0.71	0.82	0.89	0.91	0.93
Maximum Volume Stored (acre-ft) =	0.296	0.887	1.205	1.993	3.463	4.376	4.691	5.014

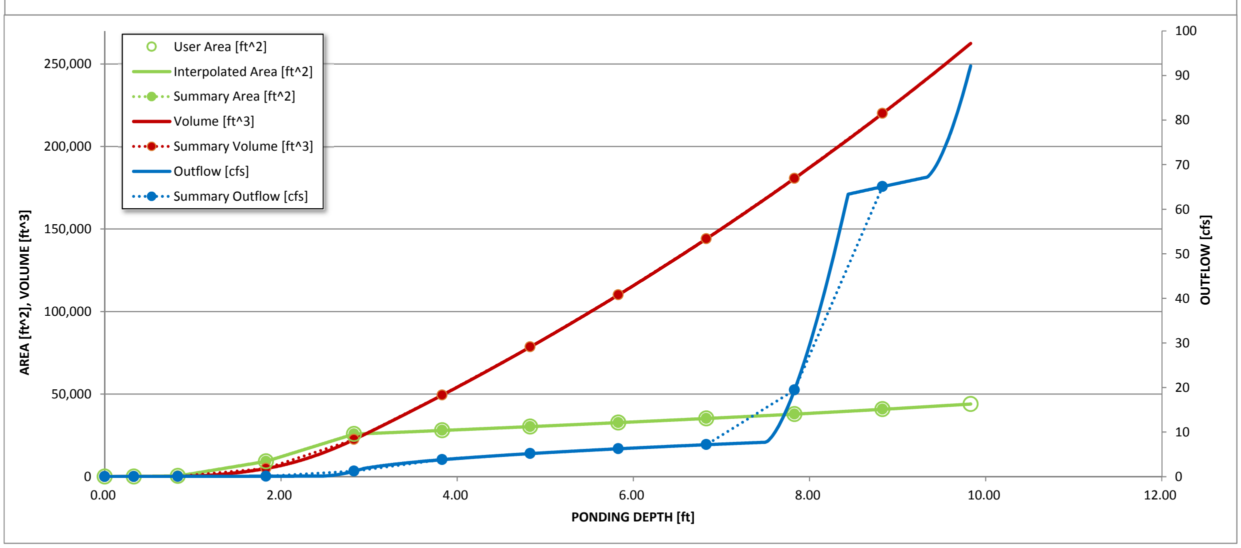
Should be kept less than or equal to 1.0

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	USER	USER	USER	USER	USER	USER	USER
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.04	0.12
	0:10:00	0.00	0.00	0.14	0.19	0.20	0.18	0.33	0.21	0.65
	0:15:00	0.00	0.00	1.43	2.19	2.66	1.86	2.27	2.22	3.10
	0:20:00	0.00	0.00	4.55	6.01	7.36	4.46	5.16	5.52	7.49
	0:25:00	0.00	0.00	10.31	15.23	19.20	10.17	12.06	13.39	19.72
	0:30:00	0.00	0.00	13.84	19.86	25.30	26.19	31.65	35.73	47.67
	0:35:00	0.00	0.00	13.71	20.66	25.10	33.00	38.51	45.09	74.02
	0:40:00	0.00	0.00	13.92	19.64	23.66	33.70	39.00	61.65	111.42
	0:45:00	0.00	0.00	13.08	18.32	22.17	32.41	64.39	95.25	111.74
	0:50:00	0.00	0.00	12.21	17.22	20.58	54.14	85.85	94.43	110.45
	0:55:00	0.00	0.00	11.43	15.92	19.72	72.28	83.75	92.68	123.35
	1:00:00	0.00	0.00	10.72	14.72	26.29	75.98	81.44	90.81	143.17
	1:05:00	0.00	0.00	10.20	13.89	33.46	73.95	79.26	88.95	150.59
	1:10:00	0.00	0.00	9.64	13.36	38.48	71.79	76.99	85.80	144.29
	1:15:00	0.00	0.00	9.14	12.94	40.69	69.89	75.01	82.97	131.46
	1:20:00	0.00	0.00	8.70	14.39	39.80	66.19	72.69	79.86	115.41
	1:25:00	0.00	0.00	8.25	15.74	36.84	56.12	70.32	76.81	99.70
	1:30:00	0.00	0.00	7.82	16.46	33.28	46.93	67.75	73.85	86.40
	1:35:00	0.00	0.00	7.42	16.66	29.95	39.11	65.18	70.96	77.71
	1:40:00	0.00	0.00	7.12	16.28	27.17	32.88	60.26	68.25	74.62
	1:45:00	0.00	0.00	6.97	15.80	25.03	28.14	45.90	65.94	72.12
	1:50:00	0.00	0.00	6.92	15.29	23.30	24.68	36.83	64.09	70.19
	1:55:00	0.00	0.00	6.71	14.74	21.70	22.10	30.83	62.47	68.56
	2:00:00	0.00	0.00	6.51	13.94	19.86	19.89	26.36	60.92	67.05
	2:05:00	0.00	0.00	6.16	12.55	17.42	17.22	22.01	47.89	64.88
	2:10:00	0.00	0.00	5.84	11.08	14.98	14.69	18.24	34.21	62.77
	2:15:00	0.00	0.00	5.58	9.72	12.80	12.50	15.15	25.37	60.81
	2:20:00	0.00	0.00	5.37	8.52	10.91	10.64	12.62	19.40	58.97
	2:25:00	0.00	0.00	5.20	7.49	9.33	9.11	10.60	15.22	44.28
	2:30:00	0.00	0.00	5.05	6.67	8.05	7.87	8.98	12.20	30.53
	2:35:00	0.00	0.00	4.93	6.08	7.05	6.91	7.72	9.99	22.05
	2:40:00	0.00	0.00	4.82	5.82	6.30	6.21	6.77	8.36	16.54
	2:45:00	0.00	0.00	4.73	5.72	5.84	5.80	6.09	7.14	12.80
	2:50:00	0.00	0.00	4.65	5.62	5.72	5.70	5.75	6.27	10.18
	2:55:00	0.00	0.00	4.57	5.55	5.62	5.61	5.65	5.74	8.32
	3:00:00	0.00	0.00	4.51	5.48	5.54	5.53	5.57	5.61	7.01
	3:05:00	0.00	0.00	4.45	5.42	5.47	5.47	5.50	5.54	6.12
	3:10:00	0.00	0.00	4.41	5.37	5.42	5.42	5.44	5.49	5.62
	3:15:00	0.00	0.00	4.37	5.33	5.38	5.38	5.40	5.45	5.54
	3:20:00	0.00	0.00	4.34	5.30	5.35	5.34	5.37	5.41	5.51
	3:25:00	0.00	0.00	4.30	5.27	5.31	5.31	5.33	5.38	5.48
	3:30:00	0.00	0.00	4.26	5.23	5.28	5.28	5.30	5.35	5.44
	3:35:00	0.00	0.00	4.23	5.20	5.25	5.24	5.27	5.32	5.41
	3:40:00	0.00	0.00	4.19	5.17	5.21	5.21	5.24	5.28	5.38
	3:45:00	0.00	0.00	4.16	5.14	5.18	5.18	5.20	5.25	5.35
	3:50:00	0.00	0.00	4.12	5.10	5.15	5.14	5.17	5.22	5.31
	3:55:00	0.00	0.00	4.09	5.07	5.11	5.11	5.14	5.18	5.28
	4:00:00	0.00	0.00	4.05	5.04	5.08	5.08	5.10	5.15	5.25
	4:05:00	0.00	0.00	4.01	5.00	5.05	5.04	5.07	5.12	5.22
	4:10:00	0.00	0.00	3.98	4.97	5.01	5.01	5.04	5.08	5.18
	4:15:00	0.00	0.00	3.94	4.93	4.98	4.98	5.00	5.05	5.15
	4:20:00	0.00	0.00	3.91	4.90	4.95	4.94	4.97	5.02	5.12
	4:25:00	0.00	0.00	3.87	4.87	4.91	4.91	4.94	4.98	5.08
	4:30:00	0.00	0.00	3.83	4.83	4.88	4.88	4.90	4.95	5.05
	4:35:00	0.00	0.00	3.80	4.80	4.85	4.84	4.87	4.92	5.02
	4:40:00	0.00	0.00	3.76	4.76	4.81	4.81	4.83	4.88	4.98
	4:45:00	0.00	0.00	3.72	4.73	4.78	4.77	4.80	4.85	4.95
	4:50:00	0.00	0.00	3.69	4.70	4.74	4.74	4.77	4.81	4.91
	4:55:00	0.00	0.00	3.65	4.66	4.71	4.71	4.73	4.78	4.88
	5:00:00	0.00	0.00	3.61	4.63	4.67	4.67	4.70	4.75	4.85
	5:05:00	0.00	0.00	3.57	4.59	4.64	4.64	4.66	4.71	4.81
	5:10:00	0.00	0.00	3.54	4.56	4.61	4.60	4.63	4.68	4.78
	5:15:00	0.00	0.00	3.50	4.52	4.57	4.57	4.59	4.64	4.74
	5:20:00	0.00	0.00	3.46	4.49	4.54	4.53	4.56	4.61	4.71
	5:25:00	0.00	0.00	3.42	4.45	4.50	4.50	4.52	4.57	4.68
	5:30:00	0.00	0.00	3.39	4.42	4.47	4.46	4.49	4.54	4.64
	5:35:00	0.00	0.00	3.35	4.38	4.43	4.43	4.45	4.50	4.61
	5:40:00	0.00	0.00	3.31	4.35	4.40	4.39	4.42	4.47	4.57
	5:45:00	0.00	0.00	3.27	4.31	4.36	4.36	4.38	4.43	4.54
	5:50:00	0.00	0.00	3.23	4.28	4.33	4.32	4.35	4.40	4.50
	5:55:00	0.00	0.00	3.20	4.24	4.29	4.29	4.31	4.36	4.47
	6:00:00	0.00	0.00	3.16	4.21	4.26	4.25	4.28	4.33	4.43

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft ^{2}]	Area [acres]	Volume [ft ^{3}]	Volume [ac-ft]	Total Outflow [cfs]
micropool	0.00	40	0.001	0	0.000	0.00
surcharge	0.33	50	0.001	15	0.000	0.02
5745	0.83	412	0.009	130	0.003	0.03
5746	1.83	9,243	0.212	4,958	0.114	0.09
5747	2.83	25,797	0.592	22,478	0.516	1.23
5748	3.83	28,015	0.643	49,384	1.134	3.81
5749	4.83	30,331	0.696	78,557	1.803	5.19
5750	5.83	32,748	0.752	110,096	2.527	6.26
5751	6.83	35,264	0.810	144,102	3.308	7.18
5752	7.83	37,880	0.870	180,674	4.148	19.44
5753	8.83	40,817	0.937	220,023	5.051	65.07

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**May 3, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C2.3**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 55.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.550

C) Contributing Watershed Area — Area = 16.000 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = ____ in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- (●) Water Quality Capture Volume (WQCV)
- ( ) Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$) — V_{DESIGN} = 0.294 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = ____ ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$ = ____ ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = ____ %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = ____ %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = ____ %

J) Excess Urban Runoff Volume (EURV) Design Volume
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

$EURV_{DESIGN}$ = ____ ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$ = ____ ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 3.00 ft / ft

DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.009 ac-ft

B) Actual Forebay Volume — V_F = 0.020 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 24.0 in **DF > DF MAXIMUM**

D) Forebay Discharge
- i) Undetained 100-year Peak Discharge — Q_{100} = 96.00 cfs
- ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 1.92 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = ____ in

G) Rectangular Notch Width — Calculated W_N = 7.2 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**May 3, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C2.3**

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 50 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 1.48 inches

E) Total Outlet Area — A_{ot} = 6.63 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 38 cu ft

C) Initial Surcharge Provided Above Micropool — V_s= 16.7 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 222 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *Other (Please describe below)*

wellscreen stainless

Other (Y/N): y

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio = 0.6

D) Total Water Quality Screen Area (based on screen type) — A_{total}= 370 sq. in. **Based on type 'Other' screen ratio**

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 3.25 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 67 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Channel Report

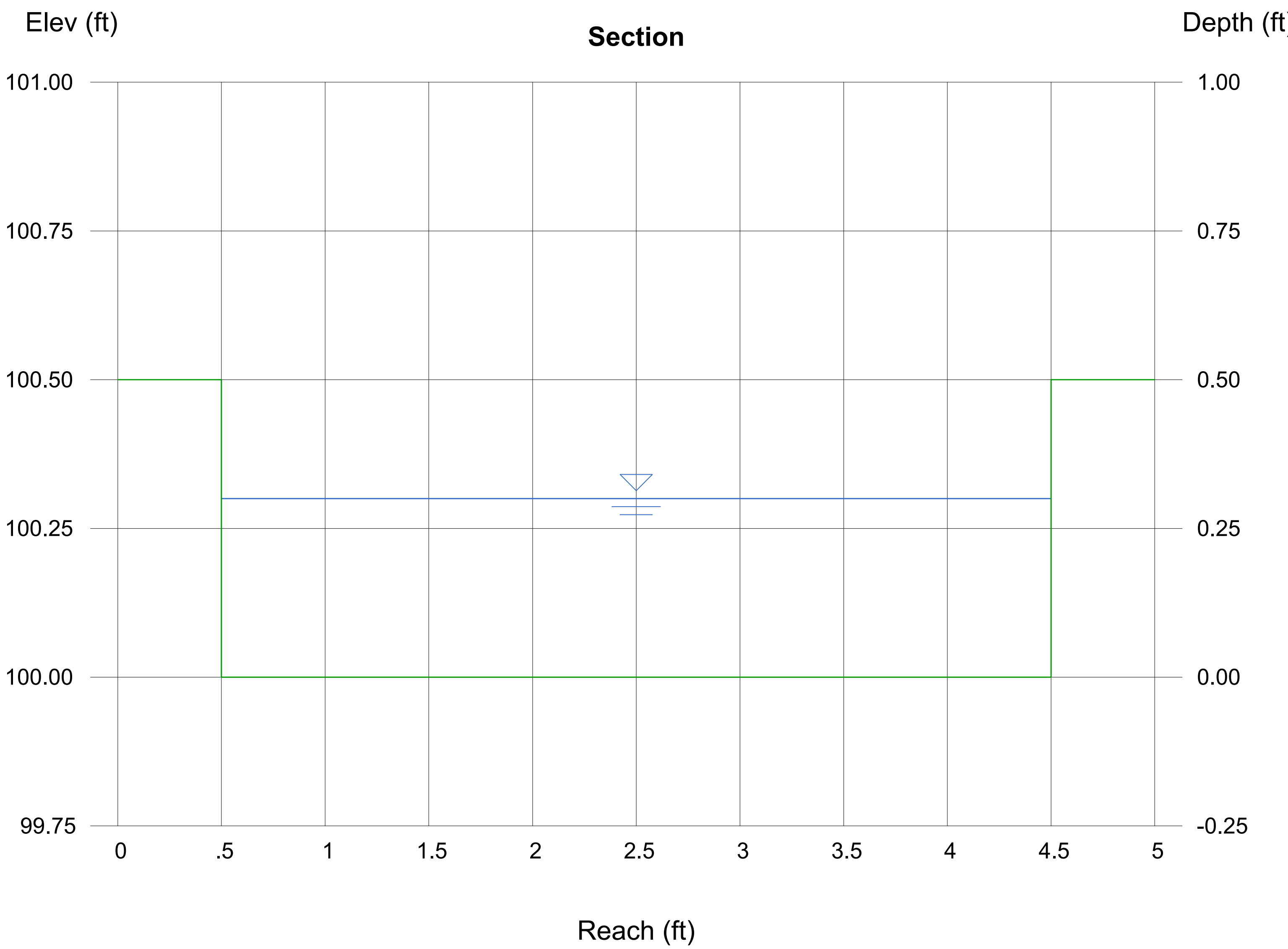
pond C2.3 low flow channel (2 x forebay release = 3.84cfs)

Rectangular
Botom Width (ft) = 4.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 3.84

Highlighted
Depth (ft) = 0.30
Q (cfs) = 3.840
Area (sqft) = 1.20
Velocity (ft/s) = 3.20
Wetted Perim (ft) = 4.60
Crit Depth, Yc (ft) = 0.31
Top Width (ft) = 4.00
EGL (ft) = 0.46



Weir Report

Pond C2.3 forebay overflow

Rectangular Weir

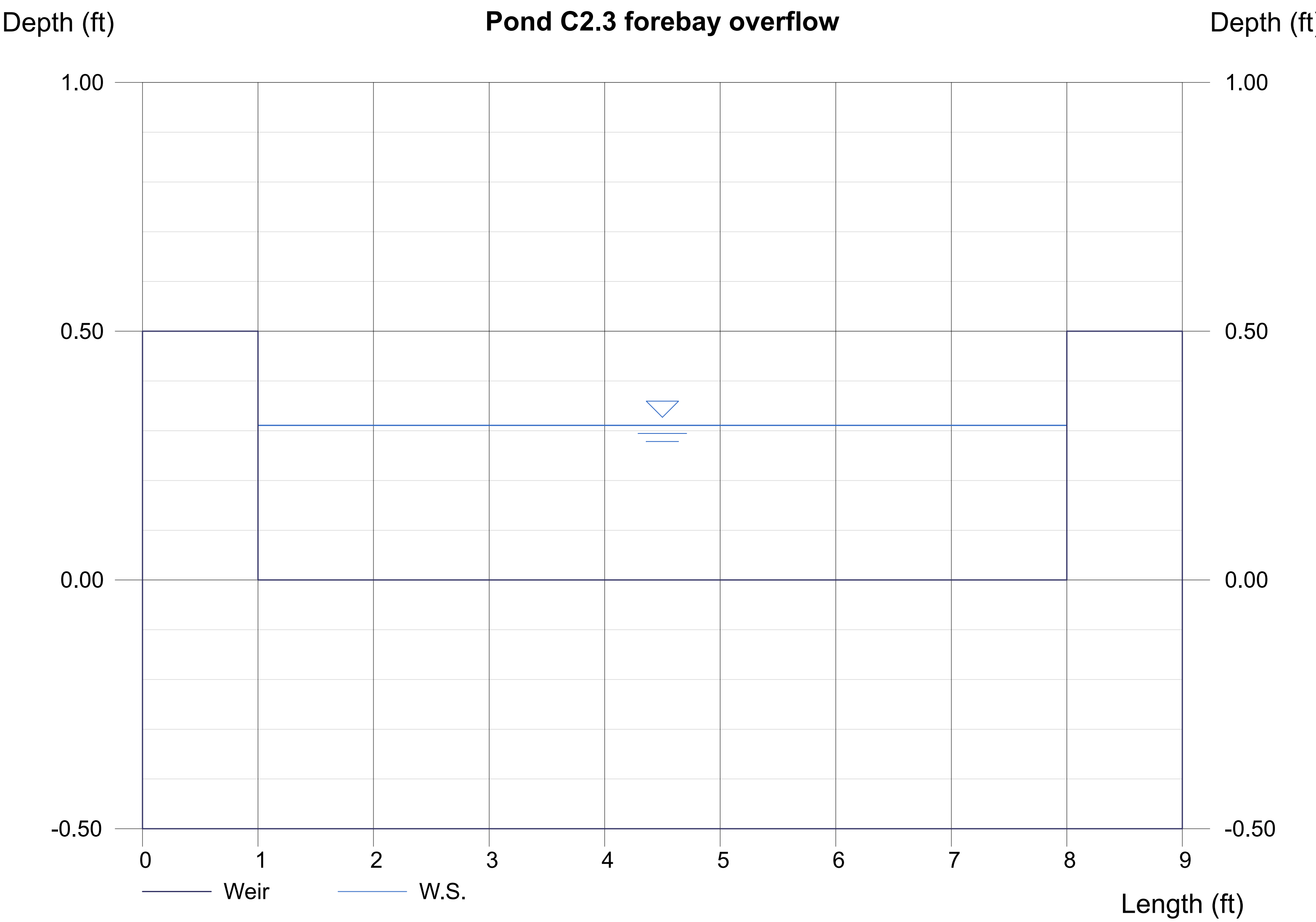
Crest	= Sharp
Bottom Length (ft)	= 7.00
Total Depth (ft)	= 0.50

Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 4.04

Highlighted

Depth (ft)	= 0.31
Q (cfs)	= 4.040
Area (sqft)	= 2.17
Velocity (ft/s)	= 1.86
Top Width (ft)	= 7.00

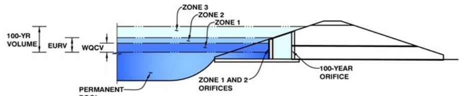


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch

Basin ID: Pond C3



Example Zone Configuration (Retention Pond)

micropool = 0 = 5755.17

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	26.00	acres		
Watershed Length =	1,800	ft		
Watershed Length to Centroid =	600	ft		
Watershed Slope =	0.040	ft/ft		
Watershed Imperviousness =	52.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	20.0%	percent		
Percentage Hydrologic Soil Groups C/D =	80.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.459	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.316	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.426	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.032	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.557	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.174	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.723	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.395	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.785	acre-feet		inches
Approximate 2-yr Detention Volume =	1.128	acre-feet		
Approximate 5-yr Detention Volume =	1.642	acre-feet		
Approximate 10-yr Detention Volume =	1.925	acre-feet		
Approximate 25-yr Detention Volume =	2.083	acre-feet		
Approximate 50-yr Detention Volume =	2.160	acre-feet		
Approximate 100-yr Detention Volume =	2.433	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.459	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.858	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	1.346	acre-feet
Total Detention Basin Volume =	2.663	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.20 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
5755.5	--	0.33	--	--	--	50	0.001	15	0.000
5756	--	0.83	--	--	--	200	0.005	280	0.006
5757	--	1.83	--	--	--	1,969	0.045	3,687	0.085
5758	--	2.83	--	--	--	15,395	0.353	19,909	0.457
5759	--	3.83	--	--	--	35,435	0.813	54,260	1.246
5760	--	4.83	--	--	--	46,802	1.074	100,093	2.298
5761	--	5.83	--	--	--	50,425	1.158	150,528	3.456
5762	--	6.83	--	--	--	54,122	1.242	204,661	4.698
5763	--	7.83	--	--	--	57,909	1.329	262,582	6.028
5764	--	8.83	--	--	--	61,796	1.419	324,293	7.445
5765	--	9.83	--	--	--	65,000	1.492	389,393	8.939
5766	--	10.83	--	--	--	69,000	1.584		
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Pond C3 Developed Inflow Hydrograph --- Pond C4 Outflow + C10 Basin

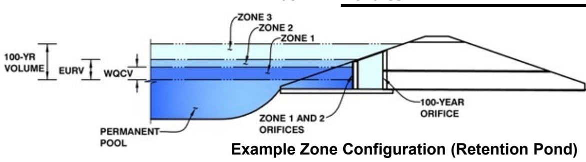
Time [hr]	Time [min]	2 Year Pond C4 Outflow2 - [cfs]	CUHP 2 Year [cfs]	2yr Combined Hydrograph	5 Year Pond C4 Outflow2 - [cfs]	CUHP 5 Year [cfs]	5yr Combined Hydrograph	10 Year Pond C4 Outflow2 - [cfs]	CUHP 10 Year [cfs]	10yr Combined Hydrograph	25 Year Pond C4 Outflow2 - [cfs]	CUHP 25 Year [cfs]	25yr Combined Hydrograph	50 Year Pond C4 Outflow2 - [cfs]	CUHP 50 Year [cfs]	50yr Combined Hydrograph	100 Year Pond C4 Outflow2 - [cfs]	CUHP 100 Year [cfs]	100yr Combined Hydrograph	500 Year Pond C4 Outflow2 - [cfs]	CUHP 500 Year [cfs]	500yr Combined Hydrograph
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.08	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.14	0.06	0.00	0.06	0.21	0.00	0.21
0.17	10.00	0.25	0.00	0.25	0.27	0.00	0.27	0.27	0.00	0.27	0.26	0.00	0.26	0.27	0.29	0.56	0.27	0.03	0.30	0.29	0.92	1.22
0.25	15.00	0.32	2.54	2.86	0.34	4.14	4.48	0.35	5.13	5.48	0.32	3.45	3.77	0.34	4.27	4.60	0.34	4.20	4.53	0.36	5.93	6.29
0.33	20.00	0.43	8.76	9.19	0.51	11.77	12.27	0.55	14.53	15.08	0.44	8.43	8.86	0.47	9.78	10.25	0.49	10.52	11.01	0.56	14.59	15.16
0.42	25.00	0.58	20.44	21.02	0.78	31.71	32.49	2.08	40.41	42.49	0.64	20.03	20.67	0.97	24.46	25.43	1.54	27.48	29.01	3.58	40.47	44.05
0.50	30.00	0.98	26.78	27.76	3.25	37.99	41.24	4.16	45.89	50.04	3.79	53.09	56.88	4.50	62.73	67.24	5.01	70.67	75.68	12.72	93.48	106.21
0.58	35.00	2.75	24.15	26.90	4.32	33.33	37.65	5.15	39.98	45.13	5.41	58.17	63.58	7.69	67.93	75.61	28.85	80.78	109.63	38.01	105.06	143.07
0.67	40.00	3.53	20.70	24.24	4.97	27.98	32.95	5.79	33.64	39.43	17.83	54.13	71.97	35.35	62.96	98.31	37.19	74.38	111.57	41.43	96.41	137.84
0.75	45.00	4.00	16.52	20.53	5.41	22.99	28.40	11.61	28.10	39.71	35.22	46.38	81.60	37.23	53.91	91.14	39.38	65.87	105.25	43.87	85.20	129.07
0.83	50.00	4.32	13.25	17.57	5.73	19.04	24.77	22.62	22.85	45.47	36.40	40.15	76.55	38.54	46.60	85.14	40.94	56.56	97.50	47.60	73.08	120.67
0.92	55.00	4.55	11.05	15.61	5.99	15.88	21.87	30.27	19.61	49.88	37.18	32.28	69.46	39.42	37.57	76.99	42.07	47.10	89.17	78.17	61.08	139.25
1.00	60.00	4.72	9.54	14.26	8.92	13.57	22.49	33.89	17.21	51.09	37.69	27.13	64.82	40.00	31.66	71.67	42.90	41.02	83.92	101.80	53.26	155.06
1.08	65.00	4.84	8.16	13.01	12.03	11.50	23.53	34.38	14.96	49.34	37.95	23.19	61.14	40.34	27.12	67.46	43.42	36.40	79.83	106.81	47.29	154.10
1.17	70.00	4.93	6.38	11.31	14.28	9.65	23.92	34.38	12.91	47.29	38.01	18.55	56.56	40.46	21.79	62.25	43.66	28.19	71.84	98.16	36.80	134.96
1.25	75.00	4.99	4.93	9.92	15.63	7.69	23.32	33.90	11.26	45.15	37.94	14.54	52.49	40.45	17.18	57.62	43.69	21.30	64.99	85.19	28.04	113.23
1.33	80.00	5.05	4.06	9.11	16.29	6.44	22.73	32.02	9.60	41.62	37.78	10.73	48.51	40.33	12.68	53.02	43.58	14.84	58.41	72.22	19.68	91.90
1.42	85.00	5.10	3.65	8.75	16.52	5.79	22.31	29.59	8.07	37.66	37.55	8.55	46.10	40.14	10.11	50.25	43.37	10.85	54.22	61.53	14.47	76.00
1.50	90.00	5.14	3.42	8.56	16.52	5.37	21.89	27.15	7.00	34.15	37.27	6.82	44.09	39.90	8.07	47.97	43.11	8.38	51.50	53.52	11.22	64.74
1.58	95.00	5.18	3.31	8.50	16.23	5.10	21.33	24.92	6.25	31.18	36.95	5.71	42.66	39.62	6.76	46.37	42.81	6.83	49.64	48.01	9.15	57.15
1.67	100.00	5.22	3.23	8.45	15.62	4.46	20.08	23.01	5.73	28.74	36.61	4.95	41.56	39.31	5.86	45.16	42.49	5.75	48.24	45.35	7.71	53.07
1.75	105.00	5.26	3.16	8.42	14.88	3.98	18.86	21.41	5.37	26.78	36.25	4.49	40.74	38.98	5.30	44.28	42.15	5.04	47.19	45.07	6.76	51.84
1.83	110.00	5.29	3.12	8.41	14.13	3.64	17.77	20.01	5.11	25.13	35.88	4.15	40.04	38.65	4.89	43.55	41.81	4.54	46.35	44.79	6.09	50.88
1.92	115.00	5.31	2.67	7.99	13.40	3.38	16.78	18.65	4.73	23.39	35.51	3.94	39.45	38.31	4.64	42.95	41.46	4.25	45.71	44.49	5.70	50.20
2.00	120.00	5.32	2.34	7.66	12.46	3.10	15.56	16.98	4.16	21.15	35.11	3.82	38.93	37.94	4.49	42.43	41.08	4.16	45.24	44.17	5.56	49.73
2.08	125.00	5.31	1.68	6.99	11.22	2.22	13.44	14.97	2.94	17.91	34.65	2.72	37.37	37.51	3.20	40.70	40.66	2.97	43.63	43.79	3.97	47.76
2.17	130.00	5.29	1.17	6.46	9.94	1.54	11.48	12.97	2.04	15.01	30.93	1.90	32.82	37.03	2.23	39.26	40.20	2.09	42.29	43.37	2.79	46.16
2.25	135.00	5.27	0.80	6.07	8.76	1.05	9.82	11.16	1.41	12.57	23.68	1.31	24.99	36.52	1.54	38.07	39.71	1.46	41.17	42.92	1.94	44.86
2.33	140.00	5.24	0.54	5.78	7.76	0.69	8.45	9.61	0.95	10.56	18.52	0.89	19.41	35.99	1.04	37.04	39.20	0.98	40.19	42.44	1.31	43.75
2.42	145.00	5.20	0.35	5.55	6.95	0.45	7.39	8.35	0.62	8.97	14.79	0.59	15.38	35.44	0.69	36.13	38.68	0.65	39.33	41.95	0.86	42.81
2.50	150.00	5.16	0.22	5.38	6.34	0.29	6.63	7.34	0.40	7.74	12.04	0.39	12.43	34.88	0.46	35.34	38.14	0.43	38.57	41.45	0.57	42.02
2.58	155.00	5.13	0.12	5.24	5.98	0.17	6.15	6.58	0.23	6.81	10.01	0.23	10.24	33.53	0.27	33.80	37.60	0.25	37.85	40.93	0.34	41.27
2.67	160.00	5.09	0.05	5.14	5.92	0.08	6.01	6.09	0.10	6.19	8.50	0.11	8.61	24.68	0.13	24.82	37.04	0.12	37.17	40.41	0.16	40.57
2.75	165.00	5.05	0.02	5.07	5.89	0.03	5.91	5.94	0.03	5.97	7.39	0.04	7.43	18.81	0.04	18.85	36.49	0.04	36.53	39.88	0.05	39.93
2.83	170.00	5.01	0.00	5.01	5.85	0.00	5.85	5.90	0.00	5.90	6.61	0.00	6.61	14.78	0.00	14.78	35.92	0.00	35.92	39.34	0.00	39.34
2.92	175.00	4.97	0.00	4.97	5.81	0.00	5.81	5.86	0.00	5.86	6.10	0.00	6.10	11.94	0.00	11.94	35.35	0.00	35.35	38.81	0.00	38.81
3.00	180.00	4.93	0.00	4.93	5.77	0.00	5.77	5.83	0.00	5.83	5.94	0.00	5.94	9.90	0.00	9.90	34.78	0.00	34.78	38.26	0.00	38.26
3.08	185.00	4.89	0.00	4.89	5.74	0.00	5.74	5.79	0.00	5.79	5.90	0.00	5.90	8.42	0.00	8.42	31.78	0.00	31.78	37.72	0.00	37.72
3.17	190.00	4.85	0.00	4.85	5.70	0.00	5.70	5.75	0.00	5.75	5.87	0.00	5.87	7.33	0.00	7.33	23.53	0.00	23.53	37.16	0.00	37.16
3.25	195.00	4.81	0.00	4.81	5.66	0.00	5.66	5.71	0.00	5.71	5.83	0.00	5.83	6.57	0.00	6.57	18.03	0.00	18.03	36.61	0.00	36.61
3.33	200.00	4.77	0.00	4.77	5.62	0.00	5.62	5.67	0.00	5.67	5.79	0.00	5.79	6.08	0.00	6.08	14.24	0.00	14.24	36.04	0.00	36.04
3.42	205.00	4.73	0.00	4.73	5.58	0.00	5.58	5.64	0.00	5.64	5.75	0.00	5.75	5.94	0.00	5.94	11.55	0.00	11.55	35.47	0.00	35.47
3.50	210.00	4.69	0.00	4.69	5.54	0.00	5.54	5.60	0.00	5.60	5.71	0.00	5.71	5.90	0.00	5.90	9.62	0.00	9.62	34.90	0.00	34.90
3.58	215.00	4.65	0.00	4.65	5.51	0.00	5.51	5.56	0.00	5.56	5.68	0.00	5.68	5.86	0.00	5.86	8.21	0.00	8.21	33.82	0.00	33.82
3.67	220.00	4.61	0.00	4.61	5.47	0.00	5.47	5.52	0.00	5.52	5.64	0.00	5.64	5.83	0.00	5.83	7.19	0.00	7.19	24.86	0.00	24.86
3.75	225.00	4.57	0.00	4.57	5.43	0.00	5.43	5.48	0.00	5.48	5.60	0.00	5.60	5.79	0.00	5.79	6.47	0.00	6.47	18.93	0.00	18.93
3.83	230.00	4.53	0.00	4.53	5.39	0.00	5.39	5.45	0.00	5.45	5.56	0.00	5.56	5.75	0.00	5.75	6.02	0.00	6.02	14.87	0.00	14.87
3.92	235.00	4.49	0.00	4.49	5.35	0.00	5.35	5.41	0.00	5.41	5.52	0.00	5.52	5.71	0.00	5.71	5.93	0.00	5.93	12.00	0.00	12.00
4.00	240.00	4.45	0.00	4.45	5.31	0.00	5.31	5.37	0.00	5.37	5.48	0.00	5.48	5.67	0.00	5.67	5.89	0.00	5.89	9.95	0.00	9.95
4.08	245.00	4.41	0.00	4.41	5.27	0.00	5.27	5.33	0.00	5.33	5.45	0.00	5.45	5.64	0.00	5.64	5.86	0.00	5.86	8.45	0.00	8.45
4.17	250.00	4.37	0.00	4.37	5.24	0.00	5.24	5.29	0.00	5.29	5.41	0.00	5.41	5.60	0.00	5.60	5.82	0.00	5.82	7.36	0.00	7.36
4.25	255.00	4.33	0.00	4.33	5.20	0.00	5.20	5.25	0.00	5.25	5.37	0.00	5.37	5.56	0.00	5.56	5.78	0.00	5.78	6.58	0.00	6.58
4.33	260.00	4.29	0.00	4.29	5.16	0.00	5.16	5.21	0.00	5.21	5.33	0.00	5.33	5.52	0.00	5.52	5.74	0.00	5.74	6.09	0.00	6.09
4.42	265.00	4.25	0.00	4.25	5.12	0.00	5.12	5.17	0.00	5.17	5.29	0.00	5.29	5.48	0.00	5.48	5.71	0.00	5.71	5.94	0.00	5.94
4.50	270.00	4.21	0.00	4.21	5.08	0.00	5.08	5.13	0.00	5.13	5.25	0.00	5.25	5.44	0.00	5.44	5.67	0.00	5.67	5.90	0.00	5.90
4.58	275.00	4.16	0.00	4.16	5.04	0.00	5.04	5.10	0.00	5.10	5.21	0.00	5.21	5.41	0.00	5.41	5.63	0.00	5.63	5.86	0.00	5.86
4.67	280.00	4.12	0.00	4.12	5.00	0.00	5.00	5.06	0.00	5.06	5.17	0.00	5.17	5.37	0.00	5.37	5.59	0.00	5.59	5.83	0.00	5.83
4.75	285.00	4.08	0.00	4.08	4.96	0.00	4.96	5.02	0.00	5.02	5.14	0.00	5.14	5.33	0.00	5.33	5.55	0.00	5.55	5.79	0.00	5.79
4.83	290.00	4.04	0.00	4.04	4.92	0.00	4.92	4.98	0.00	4.98	5.10	0.00	5.10	5.29	0.00	5.29	5.51	0.00	5.51	5.75	0.00	5.75
4.92	295.00	4.00	0.00	4.00	4.88	0.00	4.88	4.94	0.00	4.94	5.06	0.00	5.06	5.25	0.00	5.25	5.48	0.00	5.48	5.71	0.00	5.71
5.00	300.00	3.96	0.00	3.96	4.84	0.00	4.84	4.90	0.00	4.90	5.02	0.00	5.02	5.21	0.00	5.21	5.44	0.00	5.44	5.67	0.00	5.67
5.08	305.00	3.92	0.00	3.92	4.80	0.00	4.80	4.86	0.00	4.86	4.98	0.00	4.98	5.17	0.00	5.17	5.40	0.00	5.40	5.64	0.00	5.64
5.17	310.00	3.87	0.00	3.87	4.76	0.00	4.76	4.82	0.00	4.82	4.94	0.00	4.94	5.13	0.00	5.13	5.36	0.00	5.36	5.60	0.00	5.60
5.25	315.00	3.83	0.00	3.83	4.72	0.00	4.72	4.78	0.00	4.78	4.90	0.00	4.90	5.09	0.00	5.09	5.32	0.00	5.32	5.56	0.00	5.56
5.33	320.00	3.79	0.00	3.79	4.68	0.00	4.68	4.74	0.00	4.74	4.86	0.00	4.86	5.06	0.00	5.06	5.28	0.00	5.28	5.52	0.00	5.52
5.42	325.00	3.75	0.00	3.75	4.64	0.00	4.64	4.70	0.00	4.70	4.82	0.00	4.82	5.02	0.00	5.02	5.24	0.00	5.24	5.48	0.00	5.48
5.50	330.00	3.71	0.00	3.71	4.60	0.00	4.60	4.66	0.00	4.66	4.78	0.00	4.78	4.98	0.00	4.98	5.21	0.00	5.21	5.44	0.00	5.44
5.58	335.00	3.66	0.00	3.66	4.56	0.00	4.56	4.62	0.00	4.62	4.74	0.00	4.74	4.94	0.00	4.94	5.17	0.00	5.17	5.41	0.00	5.41
5.67	340.00	3.62	0.00	3.62	4.52	0.00	4.52	4.58	0.00	4.58	4.70	0.00	4.70	4.90	0.00	4.90	5.13	0.00	5.13	5.37	0.00	5.37
5.75	345.00	3.58	0.00	3.58	4.48	0.00	4.48	4.54	0.00	4.54	4.66	0.00	4.66	4.86	0.00	4.86	5.09	0.00	5.09	5.33	0.00	5.33
5.83	350.00	3.54	0.00	3.54	4.44	0.00	4.44	4.50	0.00	4.50	4.62	0.00	4.62	4.82	0.00	4.82	5.05	0.00	5.05	5.29	0.00	5.29
5.92	355.00	3.49	0.00	3.49	4.40	0.00	4.40	4.46	0.00	4.46	4.58	0.00	4.58	4.78	0.00	4.78	5.01	0.00	5.01	5.25	0.00	5.25
6.00	360.00	3.45	0.00	3.45	4.36	0.00	4.36	4.42	0.00	4.42	4.54	0.00	4.54	4.74	0.00	4.74	4.97	0.00	4.97	5.21	0.00	5.21

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Project: **The Hills at Lorson Ranch**

Basin ID: **Pond C3**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.84	0.459	Orifice Plate
Zone 2 (EURV)	3.91	0.858	Rectangular Orifice
3 (100+1/2WQCV)	5.16	1.346	Weir&Pipe (Restrict)
Total (all zones)		2.663	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

				Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)		Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches		Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

				Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)		WQ Orifice Area per Row =	9.792E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.84	ft (relative to basin bottom at Stage = 0 ft)		Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	11.40	inches		Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.41	sq. inches (diameter = 1-5/16 inches)		Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.95	1.89					
Orifice Area (sq. inches)	1.41	1.41	1.41					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected		Calculated Parameters for Vertical Orifi	Zone 2 Rectangular	Not Selected
Invert of Vertical Orifice =	2.84	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.58	N/A
Depth at top of Zone using Vertical Orifice =	3.91	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.25	N/A
Vertical Orifice Height =	6.00	N/A	inches			
Vertical Orifice Width =	14.00		inches			

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow We	Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	6.73	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.73	N/A
Overflow Weir Front Edge Length =	6.00	N/A	feet	Overflow Weir Slope Length =	6.00	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	10.94	N/A
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	25.20	N/A
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	12.60	N/A
Debris Clogging % =	50%	N/A	%			

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla	Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	0.30	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.30	N/A
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.77	N/A
Restrictor Plate Height Above Pipe Invert =	16.50		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.96	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	9.33	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.32	feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	12.33	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.00	acres
Freeboard above Max Water Surface =	1.68	feet	Basin Volume at Top of Freeboard =	#VALUE!	acre-ft

micropool = 0 = 5755.17

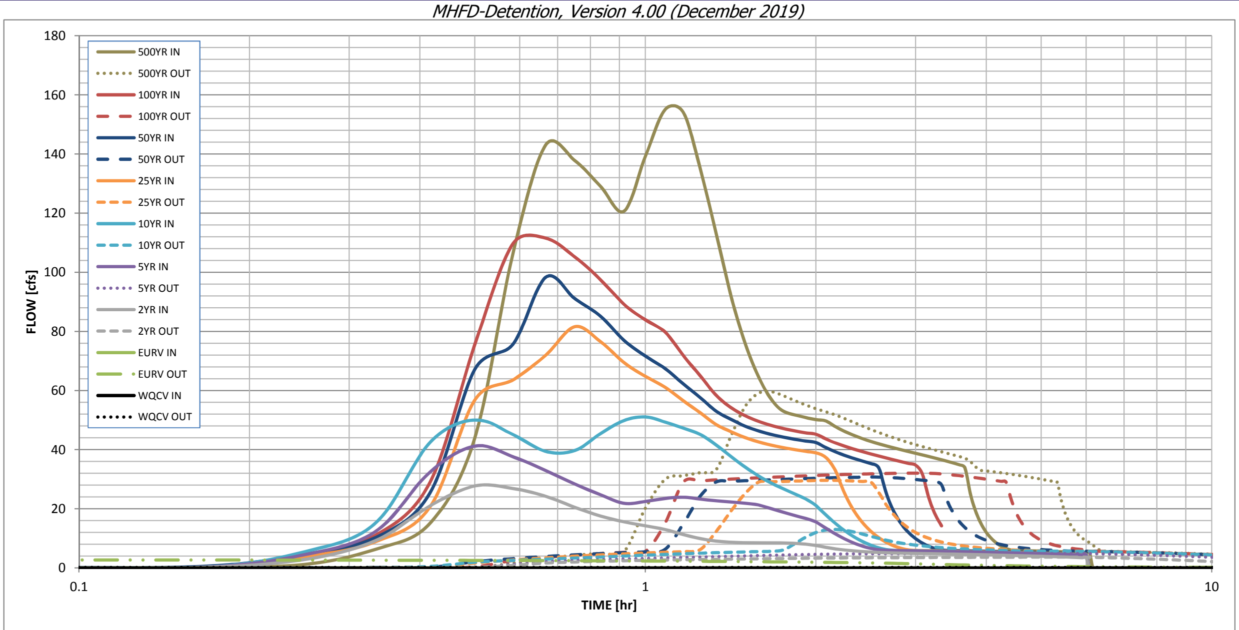
Routed Hydrograph Results

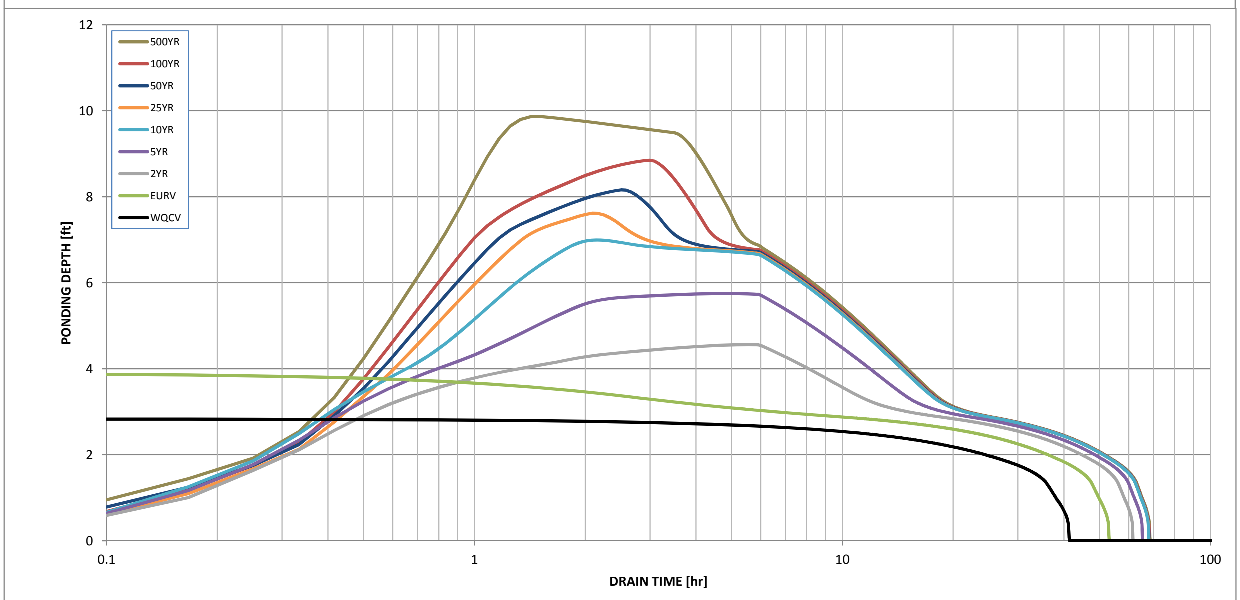
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

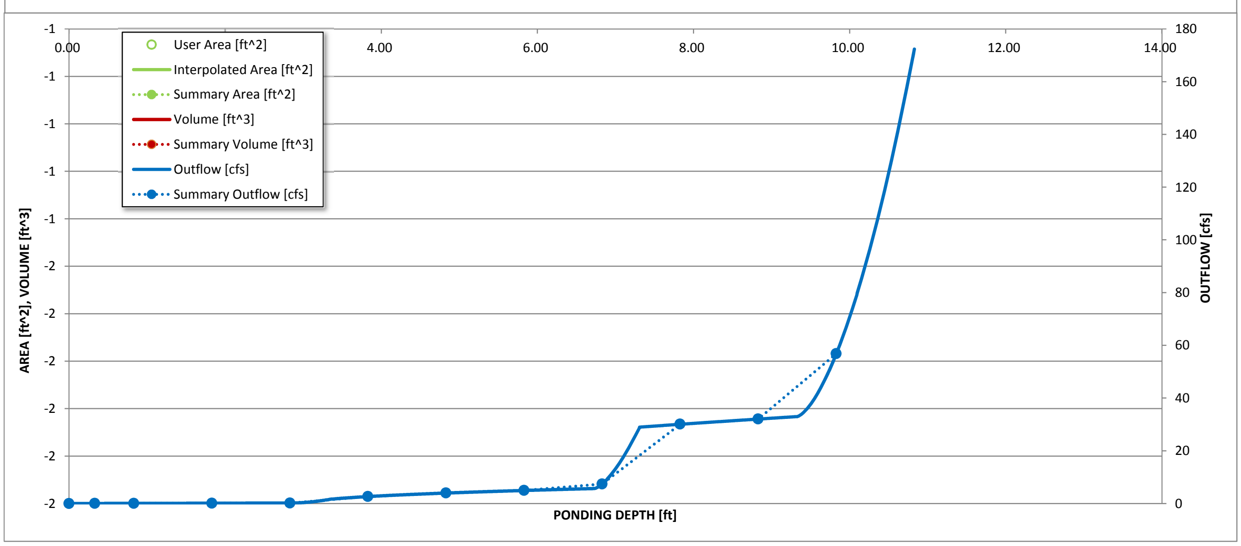
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.459	1.316	1.426	2.032	2.557	3.174	3.723	4.395
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.494	5.383	7.500	9.961	12.056	14.615
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	5.6	12.2	17.2	27.0	33.3	41.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.22	0.47	0.66	1.04	1.28	1.58
Peak Inflow Q (cfs) =	N/A	N/A	27.8	41.2	51.1	81.6	98.3	111.6
Peak Outflow Q (cfs) =	0.2	2.8	3.7	4.9	13.0	29.6	30.8	32.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.8	1.1	0.9	0.8
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.3	0.9	1.0	1.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	46	47	45	43	37	33	28
Time to Drain 99% of Inflow Volume (hours) =	**40**	49	55	56	56	54	52	49
Maximum Ponding Depth (ft) =	2.84	3.91	4.56	5.75	7.00	7.62	8.16	8.85
Area at Maximum Ponding Depth (acres) =	0.59	0.96	1.09	1.19	1.30	1.35	1.40	1.46
Maximum Volume Stored (acre-ft) =	0.463	1.322	2.000	3.348	4.905	5.728	6.486	7.459

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: *.\xxxxx.xlsx*

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	USER	USER	USER	USER	USER	USER	USER
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.06	0.21
	0:10:00	0.00	0.00	0.25	0.27	0.27	0.26	0.56	0.30	1.22
	0:15:00	0.00	0.00	2.86	4.48	5.48	3.77	4.60	4.53	6.29
	0:20:00	0.00	0.00	9.19	12.27	15.08	8.86	10.25	11.01	15.16
	0:25:00	0.00	0.00	21.02	32.49	42.49	20.67	25.43	29.01	44.05
	0:30:00	0.00	0.00	27.76	41.24	50.04	56.88	67.24	75.68	106.21
	0:35:00	0.00	0.00	26.90	37.65	45.13	63.58	75.61	109.63	143.07
	0:40:00	0.00	0.00	24.24	32.95	39.43	71.97	98.31	111.57	137.84
	0:45:00	0.00	0.00	20.53	28.40	39.71	81.60	91.14	105.25	129.07
	0:50:00	0.00	0.00	17.57	24.77	45.47	76.55	85.14	97.50	120.67
	0:55:00	0.00	0.00	15.61	21.87	49.88	69.46	76.99	89.17	139.25
	1:00:00	0.00	0.00	14.26	22.49	51.09	64.82	71.67	83.92	155.06
	1:05:00	0.00	0.00	13.01	23.53	49.34	61.14	67.46	79.83	154.10
	1:10:00	0.00	0.00	11.31	23.92	47.29	56.56	62.25	71.84	134.96
	1:15:00	0.00	0.00	9.92	23.32	45.15	52.49	57.62	64.99	113.23
	1:20:00	0.00	0.00	9.11	22.73	41.62	48.51	53.02	58.41	91.90
	1:25:00	0.00	0.00	8.75	22.31	37.66	46.10	50.25	54.22	76.00
	1:30:00	0.00	0.00	8.56	21.89	34.15	44.09	47.97	51.50	64.74
	1:35:00	0.00	0.00	8.50	21.33	31.18	42.66	46.37	49.64	57.15
	1:40:00	0.00	0.00	8.45	20.08	28.74	41.56	45.16	48.24	53.07
	1:45:00	0.00	0.00	8.42	18.86	26.78	40.74	44.28	47.19	51.84
	1:50:00	0.00	0.00	8.41	17.77	25.13	40.04	43.55	46.35	50.88
	1:55:00	0.00	0.00	7.99	16.78	23.39	39.45	42.95	45.71	50.20
	2:00:00	0.00	0.00	7.66	15.56	21.15	38.93	42.43	45.24	49.73
	2:05:00	0.00	0.00	6.99	13.44	17.91	37.37	40.70	43.63	47.76
	2:10:00	0.00	0.00	6.46	11.48	15.01	32.82	39.26	42.29	46.16
	2:15:00	0.00	0.00	6.07	9.82	12.57	24.99	38.07	41.17	44.86
	2:20:00	0.00	0.00	5.78	8.45	10.56	19.41	37.04	40.19	43.75
	2:25:00	0.00	0.00	5.55	7.39	8.97	15.38	36.13	39.33	42.81
	2:30:00	0.00	0.00	5.38	6.63	7.74	12.43	35.34	38.57	42.02
	2:35:00	0.00	0.00	5.24	6.15	6.81	10.24	33.80	37.85	41.27
	2:40:00	0.00	0.00	5.14	6.01	6.19	8.61	24.82	37.17	40.57
	2:45:00	0.00	0.00	5.07	5.91	5.97	7.43	18.85	36.53	39.93
	2:50:00	0.00	0.00	5.01	5.85	5.90	6.61	14.78	35.92	39.34
	2:55:00	0.00	0.00	4.97	5.81	5.86	6.10	11.94	35.35	38.81
	3:00:00	0.00	0.00	4.93	5.77	5.83	5.94	9.90	34.78	38.26
	3:05:00	0.00	0.00	4.89	5.74	5.79	5.90	8.42	31.78	37.72
	3:10:00	0.00	0.00	4.85	5.70	5.75	5.87	7.33	23.53	37.16
	3:15:00	0.00	0.00	4.81	5.66	5.71	5.83	6.57	18.03	36.61
	3:20:00	0.00	0.00	4.77	5.62	5.67	5.79	6.08	14.24	36.04
	3:25:00	0.00	0.00	4.73	5.58	5.64	5.75	5.94	11.55	35.47
	3:30:00	0.00	0.00	4.69	5.54	5.60	5.71	5.90	9.62	34.90
	3:35:00	0.00	0.00	4.65	5.51	5.56	5.68	5.86	8.21	33.82
	3:40:00	0.00	0.00	4.61	5.47	5.52	5.64	5.83	7.19	24.86
	3:45:00	0.00	0.00	4.57	5.43	5.48	5.60	5.79	6.47	18.93
	3:50:00	0.00	0.00	4.53	5.39	5.45	5.56	5.75	6.02	14.87
	3:55:00	0.00	0.00	4.49	5.35	5.41	5.52	5.71	5.93	12.00
	4:00:00	0.00	0.00	4.45	5.31	5.37	5.48	5.67	5.89	9.95
	4:05:00	0.00	0.00	4.41	5.27	5.33	5.45	5.64	5.86	8.45
	4:10:00	0.00	0.00	4.37	5.24	5.29	5.41	5.60	5.82	7.36
	4:15:00	0.00	0.00	4.33	5.20	5.25	5.37	5.56	5.78	6.58
	4:20:00	0.00	0.00	4.29	5.16	5.21	5.33	5.52	5.74	6.09
	4:25:00	0.00	0.00	4.25	5.12	5.17	5.29	5.48	5.71	5.94
	4:30:00	0.00	0.00	4.21	5.08	5.13	5.25	5.44	5.67	5.90
	4:35:00	0.00	0.00	4.16	5.04	5.10	5.21	5.41	5.63	5.86
	4:40:00	0.00	0.00	4.12	5.00	5.06	5.17	5.37	5.59	5.83
	4:45:00	0.00	0.00	4.08	4.96	5.02	5.14	5.33	5.55	5.79
	4:50:00	0.00	0.00	4.04	4.92	4.98	5.10	5.29	5.51	5.75
	4:55:00	0.00	0.00	4.00	4.88	4.94	5.06	5.25	5.48	5.71
	5:00:00	0.00	0.00	3.96	4.84	4.90	5.02	5.21	5.44	5.67
	5:05:00	0.00	0.00	3.92	4.80	4.86	4.98	5.17	5.40	5.64
	5:10:00	0.00	0.00	3.87	4.76	4.82	4.94	5.13	5.36	5.60
	5:15:00	0.00	0.00	3.83	4.72	4.78	4.90	5.09	5.32	5.56
	5:20:00	0.00	0.00	3.79	4.68	4.74	4.86	5.06	5.28	5.52
	5:25:00	0.00	0.00	3.75	4.64	4.70	4.82	5.02	5.24	5.48
	5:30:00	0.00	0.00	3.71	4.60	4.66	4.78	4.98	5.21	5.44
	5:35:00	0.00	0.00	3.66	4.56	4.62	4.74	4.94	5.17	5.41
	5:40:00	0.00	0.00	3.62	4.52	4.58	4.70	4.90	5.13	5.37
	5:45:00	0.00	0.00	3.58	4.48	4.54	4.66	4.86	5.09	5.33
	5:50:00	0.00	0.00	3.54	4.44	4.50	4.62	4.82	5.05	5.29
	5:55:00	0.00	0.00	3.49	4.40	4.46	4.58	4.78	5.01	5.25
	6:00:00	0.00	0.00	3.45	4.36	4.42	4.54	4.74	4.97	5.21

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
micropool	0.00	40	0.001	0	0.000	0.00
surcharge	0.33	50	0.001	15	0.000	0.03
5756	0.83	1,010	0.023	280	0.006	0.04
5757	1.83	8,682	0.199	3,687	0.085	0.11
5758	2.83	25,415	0.583	19,909	0.457	0.19
5759	3.83	41,118	0.944	54,260	1.246	2.65
5760	4.83	48,613	1.116	100,093	2.298	3.98
5761	5.83	52,273	1.200	150,528	3.456	4.96
5762	6.83	56,015	1.286	204,661	4.698	7.41
5763	7.83	59,852	1.374	262,582	6.028	30.08
5664	8.83	63,398	1.455	324,293	7.445	32.06
5765	9.83	67,000	1.538	389,393	8.939	56.83

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: Richard Schindler
Company: Core Engineering Group
Date: May 3, 2020
Project: The Hills at Lorson Ranch
Location: Pond C3

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 52.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.520
C) Contributing Watershed Area	Area = 26.000 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)	V_{DESIGN} = 0.459 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$ = ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$ = ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$ = ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 3.00 ft / ft **DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE**
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.014 ac-ft
B) Actual Forebay Volume	V_F = 0.020 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 24.0 in **DF > DF MAXIMUM**
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 96.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.92 cfs
E) Forebay Discharge Design	Choose One: ( ) Berm With Pipe (●) Wall with Rect. Notch ( ) Wall with V-Notch Weir **Flow too small for berm w/ pipe**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 7.2 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**May 3, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C3**

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 50 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 1.48 inches

E) Total Outlet Area — A_{ot} = 6.63 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 60 cu ft

C) Initial Surcharge Provided Above Micropool — V_s= 16.7 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 222 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *Other (Please describe below)*

wellscreen stainless

Other (Y/N): y

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio = 0.6

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 370 sq. in. **Based on type 'Other' screen ratio**

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 3.25 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 67 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Channel Report

Hydraflow Express by Intelisolve — Sunday, May 3 2020, 3:29 PM

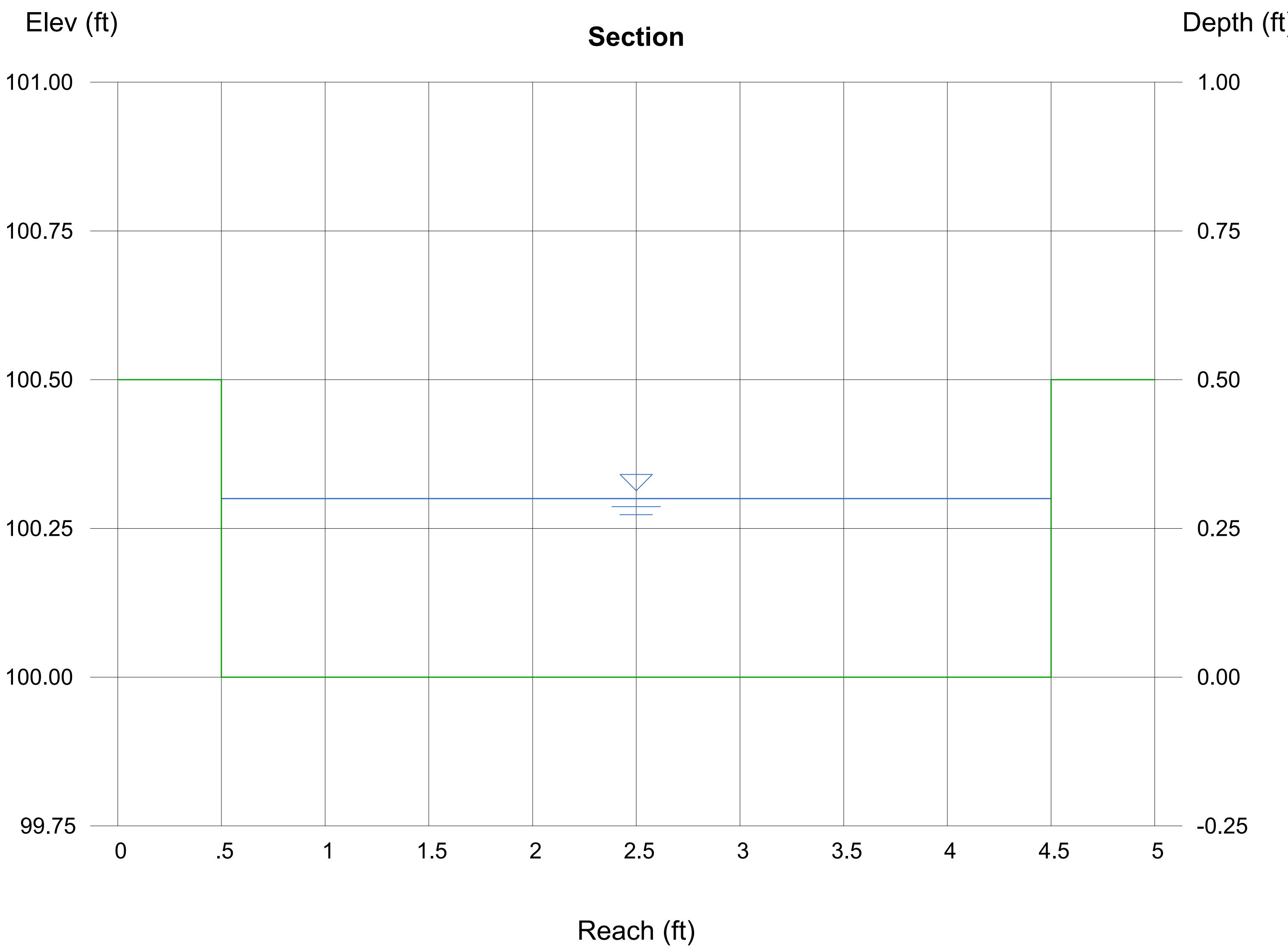
pond C3 low flow channel (2 x forebay release = 3.84cfs)

Rectangular
Botom Width (ft) = 4.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 3.84

Highlighted
Depth (ft) = 0.30
Q (cfs) = 3.840
Area (sqft) = 1.20
Velocity (ft/s) = 3.20
Wetted Perim (ft) = 4.60
Crit Depth, Yc (ft) = 0.31
Top Width (ft) = 4.00
EGL (ft) = 0.46



Weir Report

Pond C3 forebay overflow

Rectangular Weir

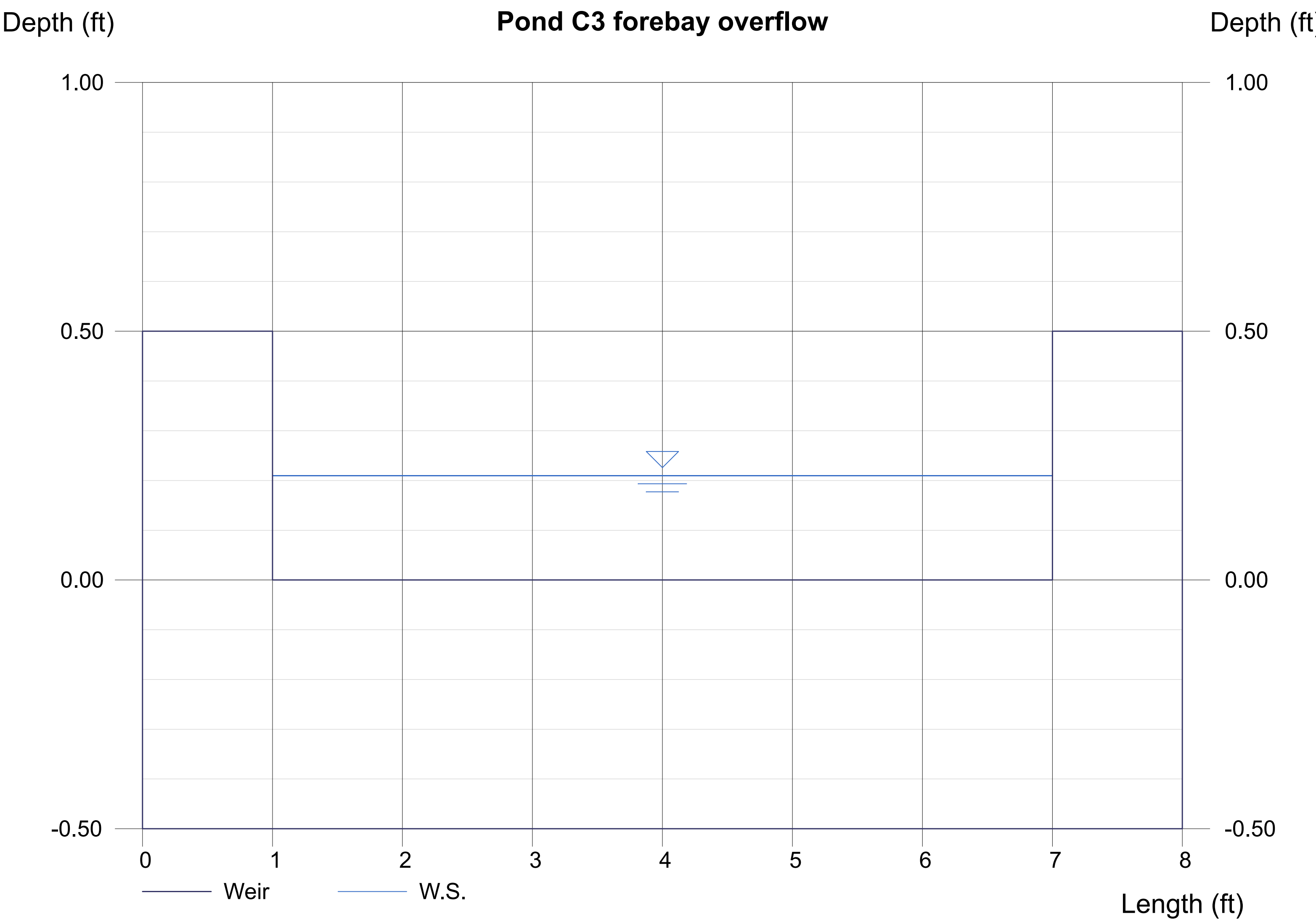
Crest	=	Sharp
Bottom Length (ft)	=	6.00
Total Depth (ft)	=	0.50

Calculations

Weir Coeff. Cw	=	3.33
Compute by:		Known Q
Known Q (cfs)	=	1.92

Highlighted

Depth (ft)	=	0.21
Q (cfs)	=	1.920
Area (sqft)	=	1.26
Velocity (ft/s)	=	1.53
Top Width (ft)	=	6.00

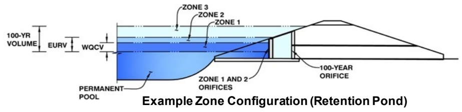


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.02 (February 2020)

Project: **The Hills at Lorson Ranch**

Basin ID: **Pond C4**



Example Zone Configuration (Retention Pond)

micropool = 0 = 5765

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	81.00	acres		
Watershed Length =	2,300	ft		
Watershed Length to Centroid =	1,200	ft		
Watershed Slope =	0.050	ft/ft		
Watershed Imperviousness =	55.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	40.0%	percent		
Percentage Hydrologic Soil Groups C/D =	60.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.488	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.468	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.607	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.475	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	8.109	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	10.045	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	11.748	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	13.830	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	18.178	acre-feet		inches
Approximate 2-yr Detention Volume =	3.723	acre-feet		
Approximate 5-yr Detention Volume =	5.293	acre-feet		
Approximate 10-yr Detention Volume =	6.364	acre-feet		
Approximate 25-yr Detention Volume =	6.876	acre-feet		
Approximate 50-yr Detention Volume =	7.136	acre-feet		
Approximate 100-yr Detention Volume =	7.948	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.488	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.980	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	4.225	acre-feet
Total Detention Basin Volume =	8.692	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.20 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
5765.33	--	0.33	--	--	--	50	0.001	15	0.000
5766	--	1.00	--	--	--	630	0.014	243	0.006
5767	--	2.00	--	--	--	40,811	0.937	20,962	0.481
5768	--	3.00	--	--	--	49,929	1.146	66,332	1.523
5769	--	4.00	--	--	--	52,779	1.212	117,686	2.702
5770	--	5.00	--	--	--	55,690	1.278	171,921	3.947
5771	--	6.00	--	--	--	58,660	1.347	229,096	5.259
5772	--	7.00	--	--	--	61,704	1.417	289,278	6.641
5773	--	8.00	--	--	--	64,811	1.488	352,535	8.093
5774	--	9.00	--	--	--	67,980	1.561	418,931	9.617
5775	--	10.00	--	--	--	71,215	1.635	488,528	11.215
5776	--	11.00	--	--	--	75,000	1.722	561,636	12.893
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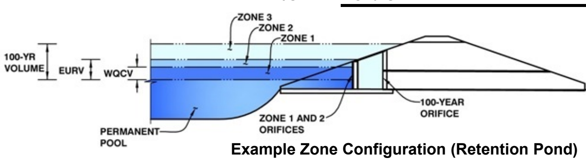
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Project: The Hills at Lorson Ranch

Basin ID: Pond C4



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.97	1.488	Orifice Plate
Zone 2 (EURV)	5.41	2.980	Rectangular Orifice
Z3 (100+1/2WQCV)	8.40	4.225	Weir&Pipe (Restrict)
Total (all zones)		8.692	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.97	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	11.90	inches
Orifice Plate: Orifice Area per Row =	4.68	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	3.250E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.99	1.98					
Orifice Area (sq. inches)	4.68	4.68	4.68					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.97	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.41	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	16.39		inches

Calculated Parameters for Vertical Orifi

	Zone 2 Rectangular	Not Selected
Vertical Orifice Area =	0.68	N/A
Vertical Orifice Centroid =	0.25	N/A

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow We

	Zone 3 Weir	Not Selected
Height of Grate Upper Edge, H_t =	5.50	N/A
Overflow Weir Slope Length =	6.00	N/A
Grate Open Area / 100-yr Orifice Area =	8.02	N/A
Overflow Grate Open Area w/o Debris =	25.20	N/A
Overflow Grate Open Area w/ Debris =	12.60	N/A

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	24.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected
Outlet Orifice Area =	3.14	N/A
Outlet Orifice Centroid =	1.00	N/A
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.13	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.87	feet
Stage at Top of Freeboard =	13.00	feet
Basin Area at Top of Freeboard =	1.72	acres
Basin Volume at Top of Freeboard =	12.89	acre-ft

micropool = 0 = 5765

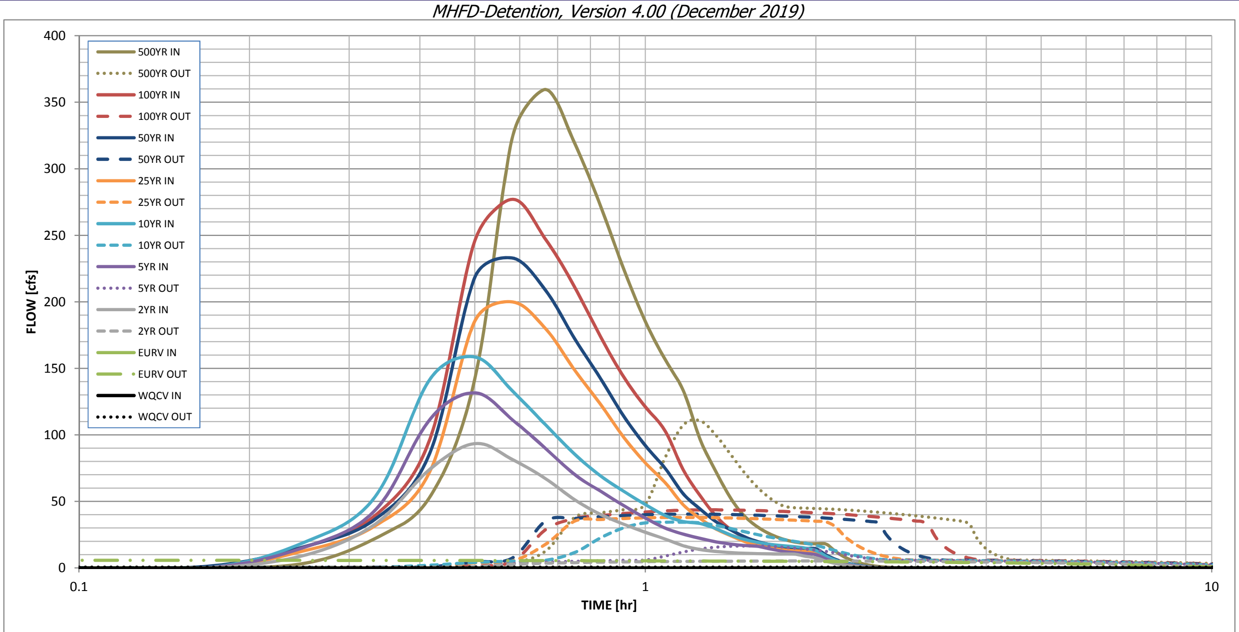
Routed Hydrograph Results

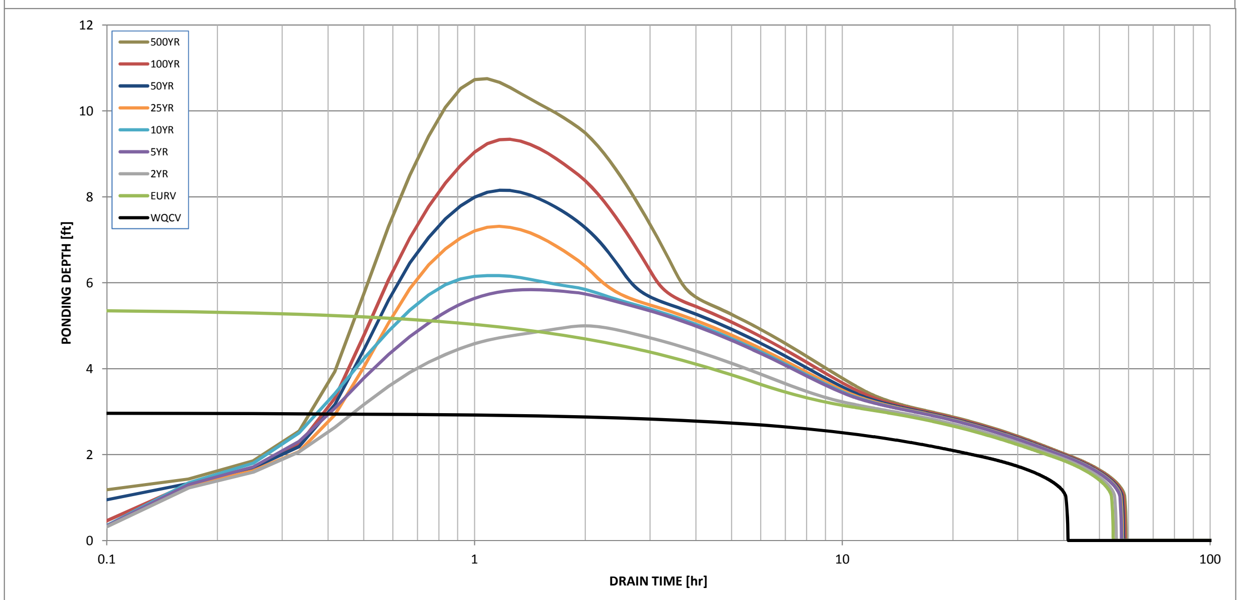
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

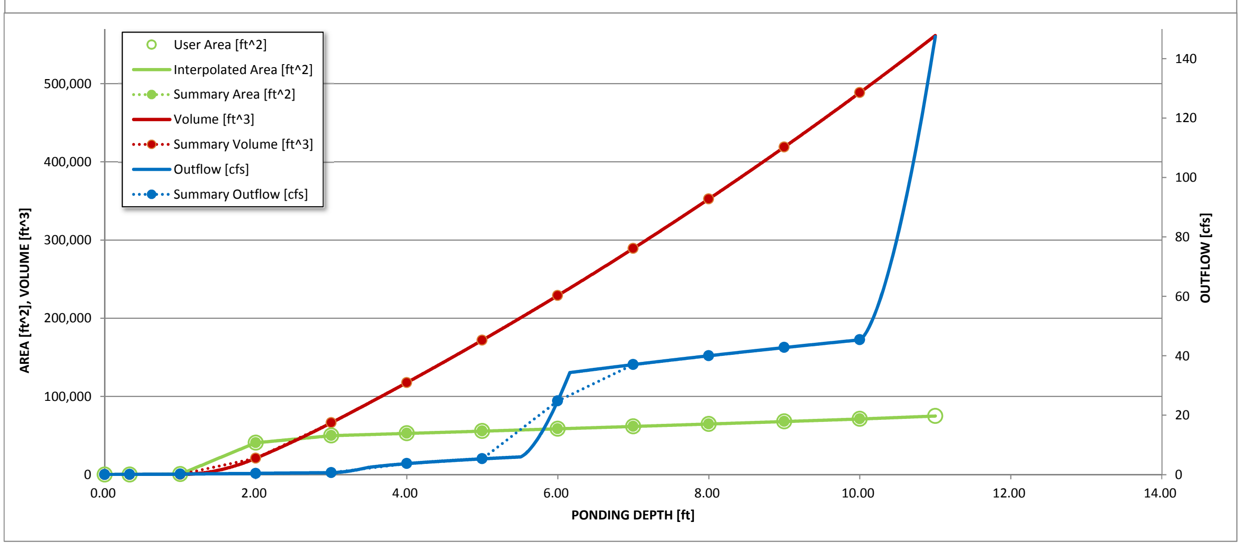
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	1.488	4.468	4.607	6.475	8.109	10.045	11.748	13.830
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.607	6.475	8.109	10.045	11.748	13.830
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	17.5	39.6	56.8	90.6	111.9	138.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.22	0.49	0.70	1.12	1.38	1.71
Peak Inflow Q (cfs) =	N/A	N/A	93.5	131.6	158.6	200.0	232.9	277.2
Peak Outflow Q (cfs) =	0.6	5.8	5.3	16.5	34.4	38.0	40.5	43.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.4	0.4	0.3
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.4	1.1	1.2	1.3	1.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	48	49	49	47	45	44	42
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	53	54	53	53	53	52
Maximum Ponding Depth (ft) =	2.97	5.41	5.00	5.84	6.17	7.31	8.15	9.34
Area at Maximum Ponding Depth (acres) =	1.14	1.31	1.28	1.34	1.36	1.44	1.50	1.59
Maximum Volume Stored (acre-ft) =	1.488	4.477	3.934	5.031	5.476	7.083	8.317	10.152

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: *.\Outflow Hydrographs-pond C4.xlsx*

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	1.08	0.11	3.48
	0:15:00	0.00	0.00	9.55	15.60	19.32	12.98	16.07	15.80	22.32
	0:20:00	0.00	0.00	32.92	43.38	53.47	31.67	36.70	39.53	53.64
	0:25:00	0.00	0.00	74.34	111.85	142.03	72.79	86.79	97.17	142.25
	0:30:00	0.00	0.00	93.50	131.62	158.60	185.73	218.67	246.14	324.95
	0:35:00	0.00	0.00	81.33	111.11	132.69	199.96	232.94	277.21	359.64
	0:40:00	0.00	0.00	67.06	89.76	107.50	179.81	208.60	246.90	319.22
	0:45:00	0.00	0.00	51.28	70.23	85.54	148.69	172.31	211.27	272.12
	0:50:00	0.00	0.00	40.21	57.70	69.19	122.99	142.40	173.74	224.11
	0:55:00	0.00	0.00	32.87	46.75	57.49	97.93	113.76	143.17	185.13
	1:00:00	0.00	0.00	26.74	37.48	47.65	78.91	91.95	121.14	156.73
	1:05:00	0.00	0.00	21.83	29.98	39.43	64.22	74.98	103.05	133.25
	1:10:00	0.00	0.00	16.70	25.41	34.92	47.41	55.74	73.66	96.29
	1:15:00	0.00	0.00	13.82	22.23	33.34	37.17	44.19	54.17	72.10
	1:20:00	0.00	0.00	12.38	19.62	29.44	29.18	34.65	38.85	51.95
	1:25:00	0.00	0.00	11.55	17.93	24.66	24.13	28.54	28.70	38.45
	1:30:00	0.00	0.00	11.12	16.83	21.38	19.70	23.24	22.76	30.51
	1:35:00	0.00	0.00	10.79	16.17	19.14	16.72	19.67	18.74	25.11
	1:40:00	0.00	0.00	10.57	14.11	17.68	14.89	17.48	16.17	21.68
	1:45:00	0.00	0.00	10.43	12.53	16.70	13.64	15.97	14.54	19.48
	1:50:00	0.00	0.00	10.39	11.49	15.99	12.96	15.14	13.84	18.51
	1:55:00	0.00	0.00	8.80	10.81	14.89	12.55	14.64	13.56	18.10
	2:00:00	0.00	0.00	7.56	10.02	13.19	12.34	14.40	13.50	18.01
	2:05:00	0.00	0.00	5.14	6.81	8.96	8.46	9.87	9.31	12.40
	2:10:00	0.00	0.00	3.31	4.38	5.83	5.51	6.42	6.07	8.07
	2:15:00	0.00	0.00	2.13	2.77	3.73	3.57	4.15	3.92	5.21
	2:20:00	0.00	0.00	1.28	1.69	2.28	2.18	2.54	2.39	3.17
	2:25:00	0.00	0.00	0.73	1.04	1.36	1.35	1.57	1.48	1.96
	2:30:00	0.00	0.00	0.36	0.56	0.70	0.74	0.85	0.80	1.06
	2:35:00	0.00	0.00	0.14	0.23	0.27	0.31	0.35	0.33	0.43
	2:40:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.06	0.08
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.02 (February 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft ^{2}]	Area [acres]	Volume [ft ^{3}]	Volume [ac-ft]	Total Outflow [cfs]
micropool	0.00	40	0.001	0	0.000	0.00
surcharge	0.33	50	0.001	15	0.000	0.09
5766	1.00	630	0.014	243	0.006	0.17
5767	2.00	40,811	0.937	20,962	0.481	0.40
5768	3.00	49,929	1.146	66,332	1.523	0.66
5769	4.00	52,779	1.212	117,686	2.702	3.71
5770	5.00	55,690	1.278	171,921	3.947	5.32
5771	6.00	58,660	1.347	229,096	5.259	24.83
5772	7.00	61,704	1.417	289,278	6.641	37.05
5773	8.00	64,811	1.488	352,535	8.093	40.02
5774	9.00	67,980	1.561	418,931	9.617	42.78
5775	10.00	71,215	1.635	488,528	11.215	45.38

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: Richard Schindler
Company: Core Engineering Group
Date: May 4, 2020
Project: The Hills at Lorson Ranch
Location: Pond C4

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 55.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.550

C) Contributing Watershed Area — Area = 81.000 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- (●) Water Quality Capture Volume (WQCV)
- ( ) Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$) — V_{DESIGN} = 1.488 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$ = ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = %

J) Excess Urban Runoff Volume (EURV) Design Volume — $EURV_{DESIGN}$ = ac-f t
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$ = ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 3.00 ft / ft

DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.045 ac-ft

B) Actual Forebay Volume — V_F = 0.050 ac-ft

C) Forebay Depth (D_F = 30 inch maximum) — D_F = 24.0 in

D) Forebay Discharge
- i) Undetained 100-year Peak Discharge — Q_{100} = 277.00 cfs
- ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 5.54 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = in

G) Rectangular Notch Width — Calculated W_N = 11.9 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**May 4, 2020**
Project:	**The Hills at Lorson Ranch**
Location:	**Pond C4**

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 50 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 2.16 inches

E) Total Outlet Area — A_{ot} = 14.04 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 194 cu ft

C) Initial Surcharge Provided Above Micropool — V_s= 16.7 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 440 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *Other (Please describe below)*

wellscreen stainless

Other (Y/N): y

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio = 0.6

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 734 sq. in. **Based on type 'Other' screen ratio**

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 2.97 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 63.64 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Channel Report

pond C4 low flow channel (2 x forebay release = 11.08cfs)

Rectangular

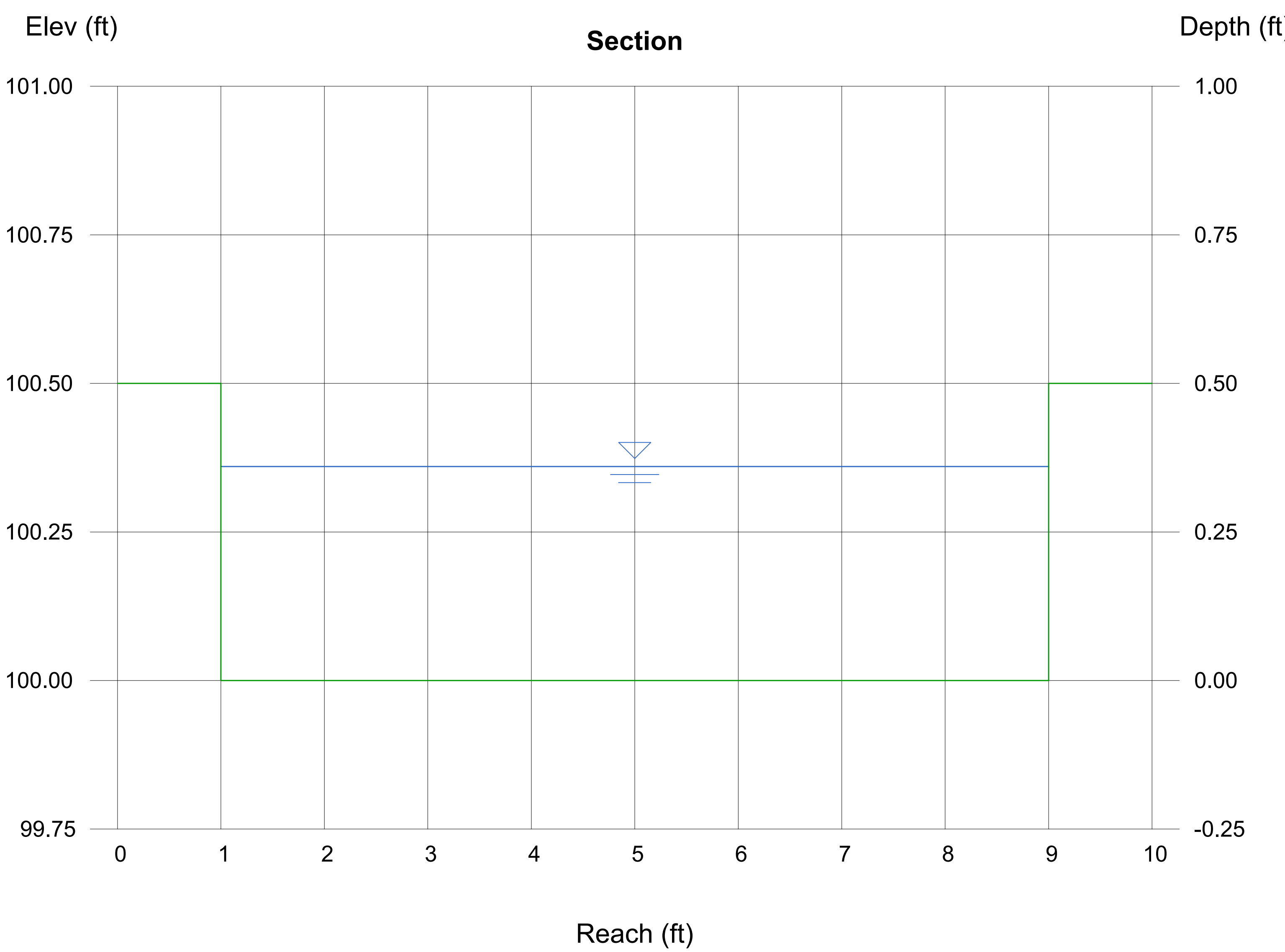
Botom Width (ft)	= 8.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.08

Highlighted

Depth (ft)	= 0.36
Q (cfs)	= 11.08
Area (sqft)	= 2.88
Velocity (ft/s)	= 3.85
Wetted Perim (ft)	= 8.72
Crit Depth, Yc (ft)	= 0.40
Top Width (ft)	= 8.00
EGL (ft)	= 0.59



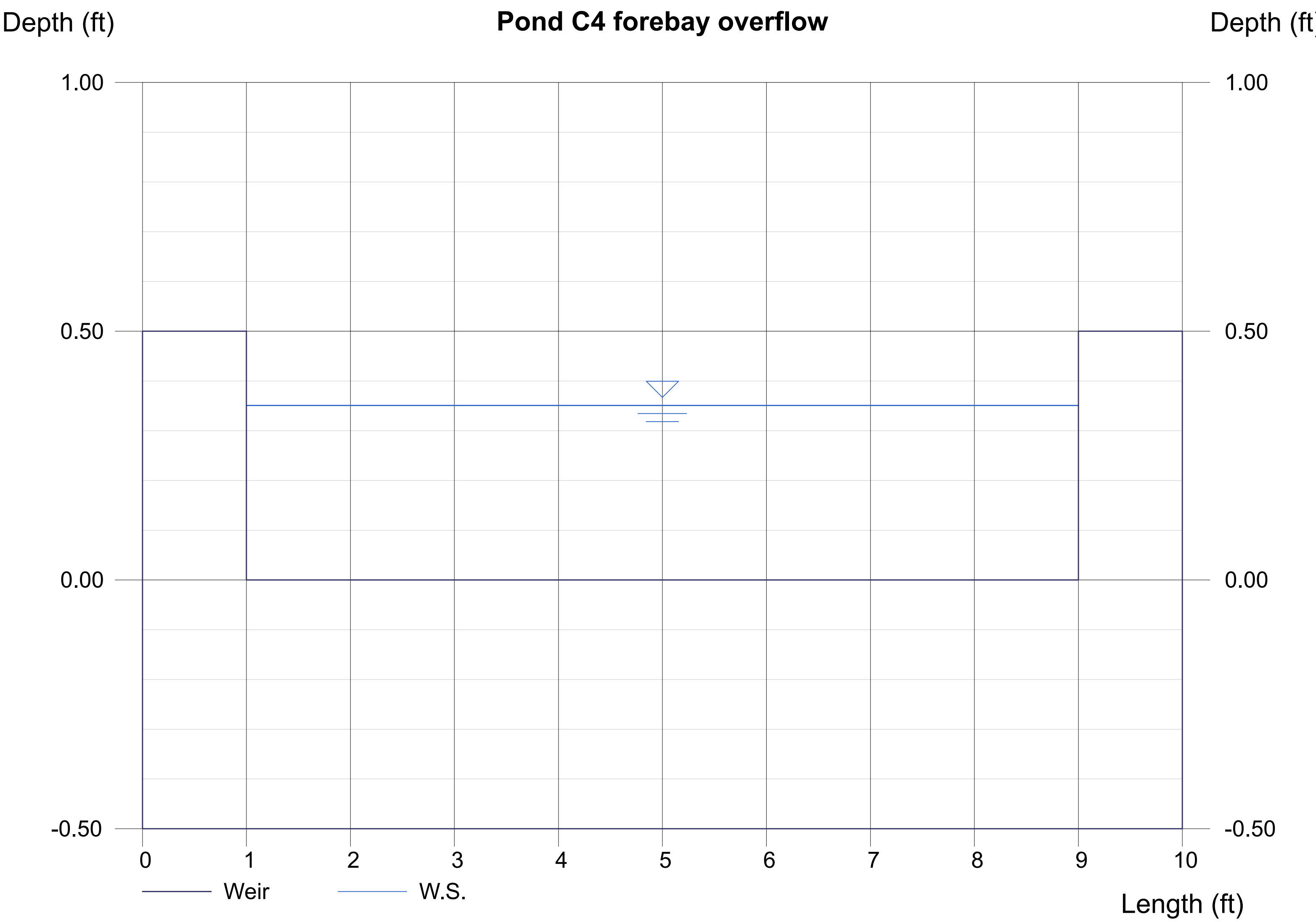
Weir Report

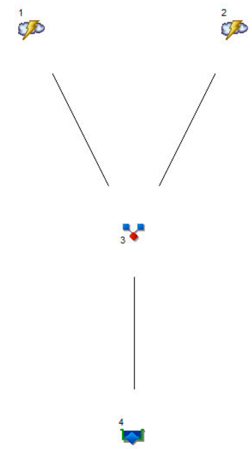
Pond C4 forebay overflow

Rectangular Weir
Crest = Sharp
Bottom Length (ft) = 8.00
Total Depth (ft) = 0.50

Calculations
Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 5.54

Highlighted
Depth (ft) = 0.35
Q (cfs) = 5.540
Area (sqft) = 2.81
Velocity (ft/s) = 1.97
Top Width (ft) = 8.00





Legend

Hyd.	**Origin**	**Description**
1	Rational	Basin C2.2-ex
2	Rational	Basins C4.4, 4.5, 4.6
3	Combine	Pond C2.1 interim inflow
4	Reservoir	Pond C2.1 Interim Out

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	12.08	1	35	25,368	----	------	------	Basin C2.2-ex
2	Rational	12.82	1	13	9,997	----	------	------	Basins C4.4, 4.5, 4.6
3	Combine	17.30	1	13	35,364	1, 2	------	------	Pond C2.1 interim inflow
4	Reservoir	11.42	1	22	35,363	3	5761.40	5,010	Pond C.1 Interim Outfl

pond c2.1 existing-5yr.gpw	Return Period: 5 Year	Thursday, May 7 2020, 6:46 AM

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	81.07	1	35	170,249	----	------	------	Basin C2.2-ex
2	Rational	31.05	1	13	24,219	----	------	------	Basins C4.4, 4.5, 4.6
3	Combine	81.07	1	35	194,469	1, 2	------	------	Pond C2.1 interim inflow
4	Reservoir	39.26	1	53	194,468	3	5764.01	86,040	Pond C.1 Interim Outfl

pond c2.1 existing-100yr.gpw	Return Period: 100 Year	Thursday, May 7 2020, 6:42 AM

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, May 7 2020, 6:42 AM

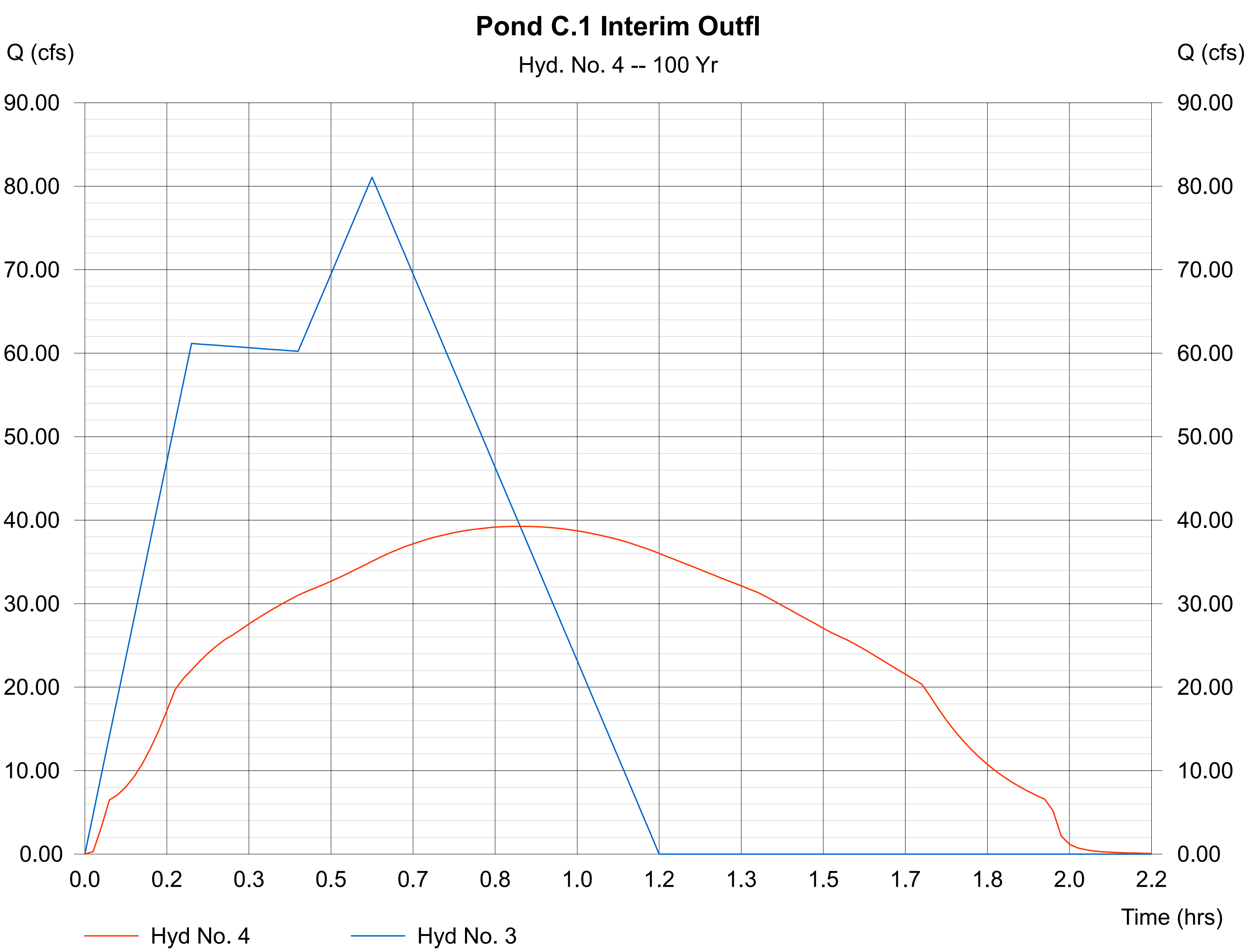
Hyd. No. 4

Pond C.1 Interim Outfl

Hydrograph type	=	Reservoir	Peak discharge	=	39.26 cfs
Storm frequency	=	100 yrs	Time interval	=	1 min
Inflow hyd. No.	=	3	Max. Elevation	=	5764.01 ft
Reservoir name	=	Pond C2.1	Max. Storage	=	86,040 cuft

Storage Indication method used.

Hydrograph Volume = 194,468 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Thursday, May 7 2020, 6:42 AM

Pond No. 1 - Pond C2.1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5760.00	42	0	0
1.00	5761.00	1,264	653	653
2.00	5762.00	20,478	10,871	11,524
3.00	5763.00	41,417	30,948	42,472
4.00	5764.00	44,796	43,107	85,578
5.00	5765.00	48,239	46,518	132,096
6.00	5766.00	51,758	49,999	182,094
7.00	5767.00	55,348	53,553	235,647
8.00	5768.00	59,010	57,179	292,826
9.00	5769.00	62,743	60,877	353,703

Culvert / Orifice Structures

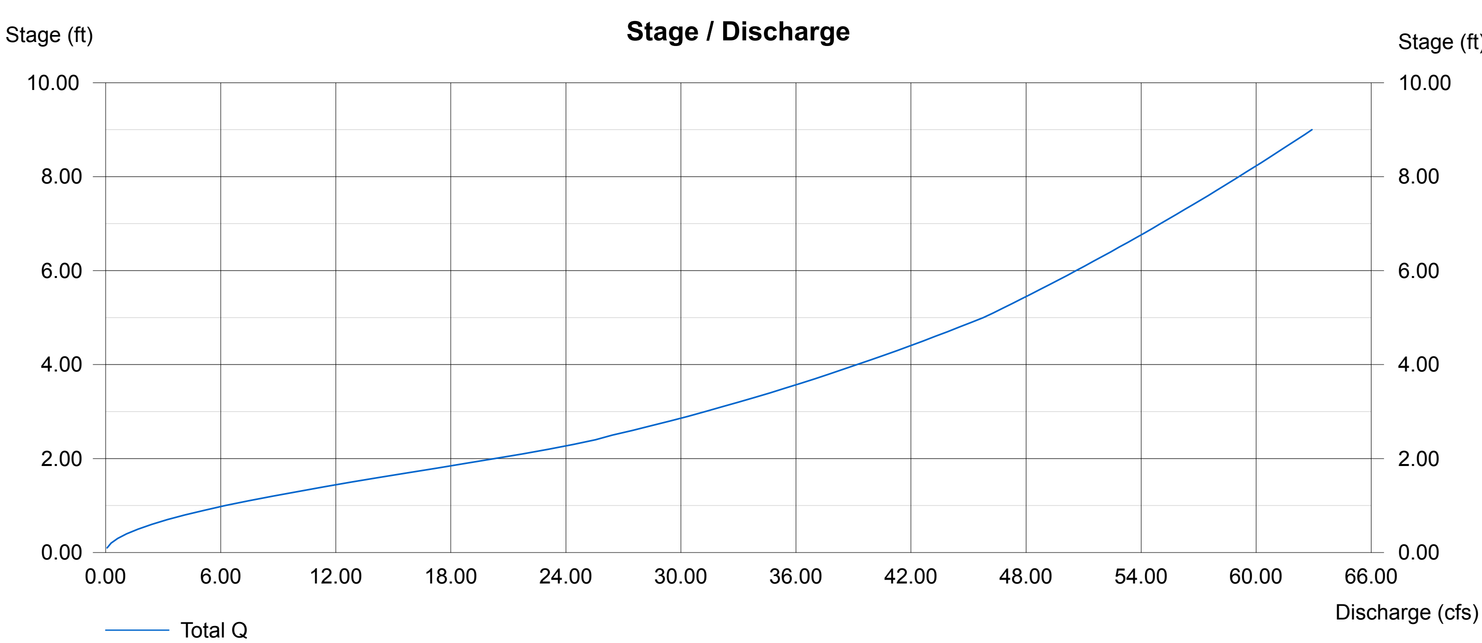
	[A]	[B]	[C]	[D]
Rise (in)	= 30.00	0.00	0.00	0.00
Span (in)	= 30.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5760.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

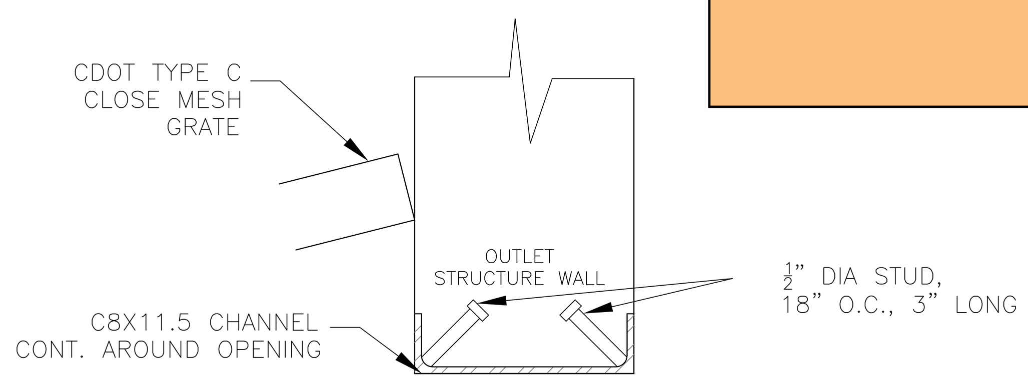
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

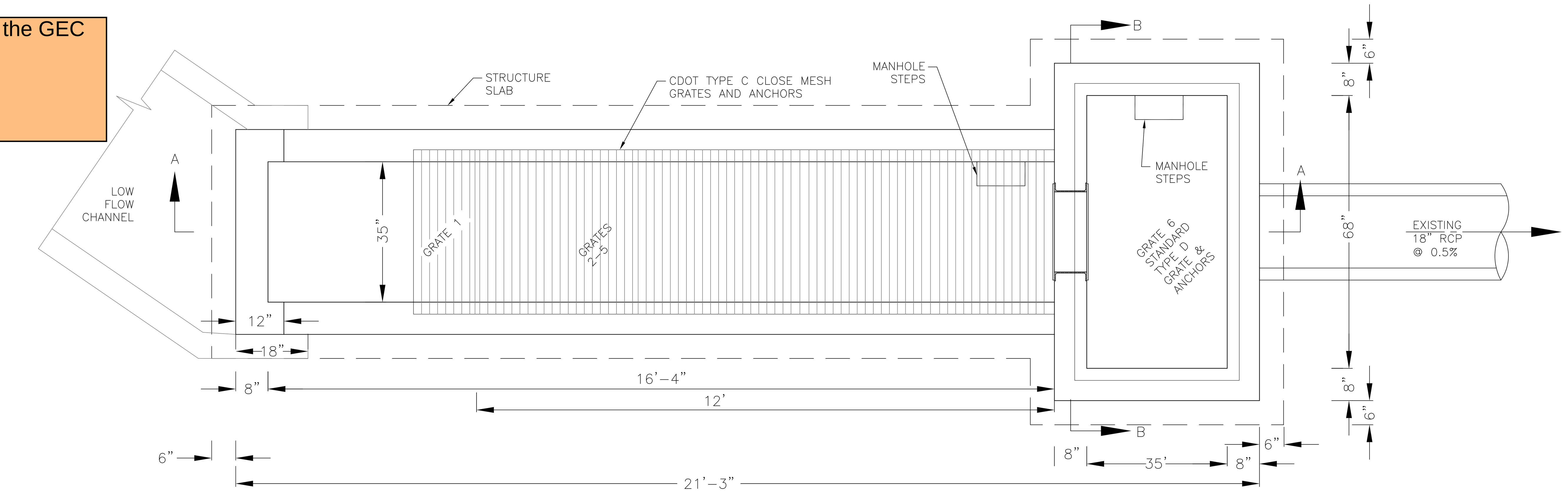
Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



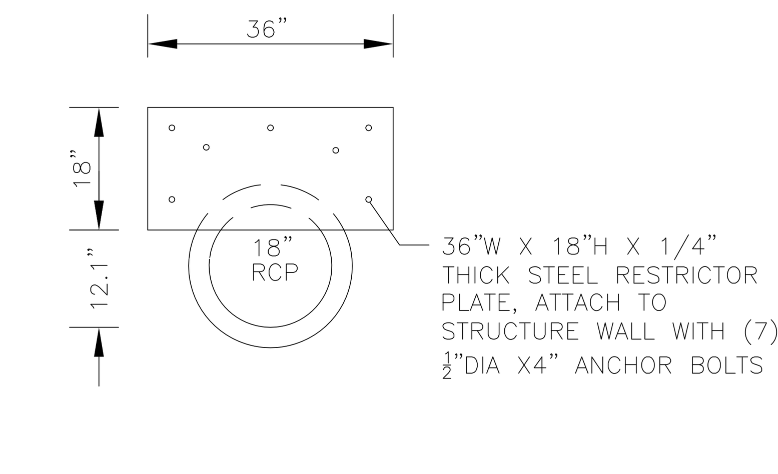
Include these pond details in the GEC Plan.



DETAIL A
NO SCALE

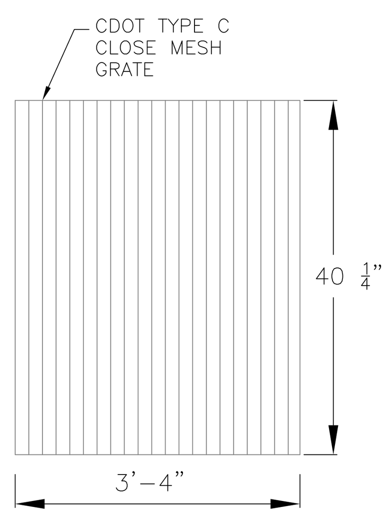


OUTLET STRUCTURE DETAIL – PLAN VIEW
NO SCALE

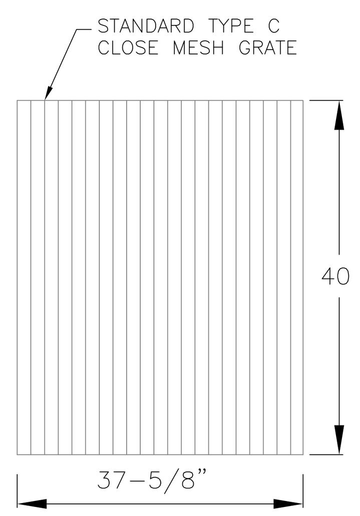


OUTLET RESTRICTOR PLATE
NO SCALE

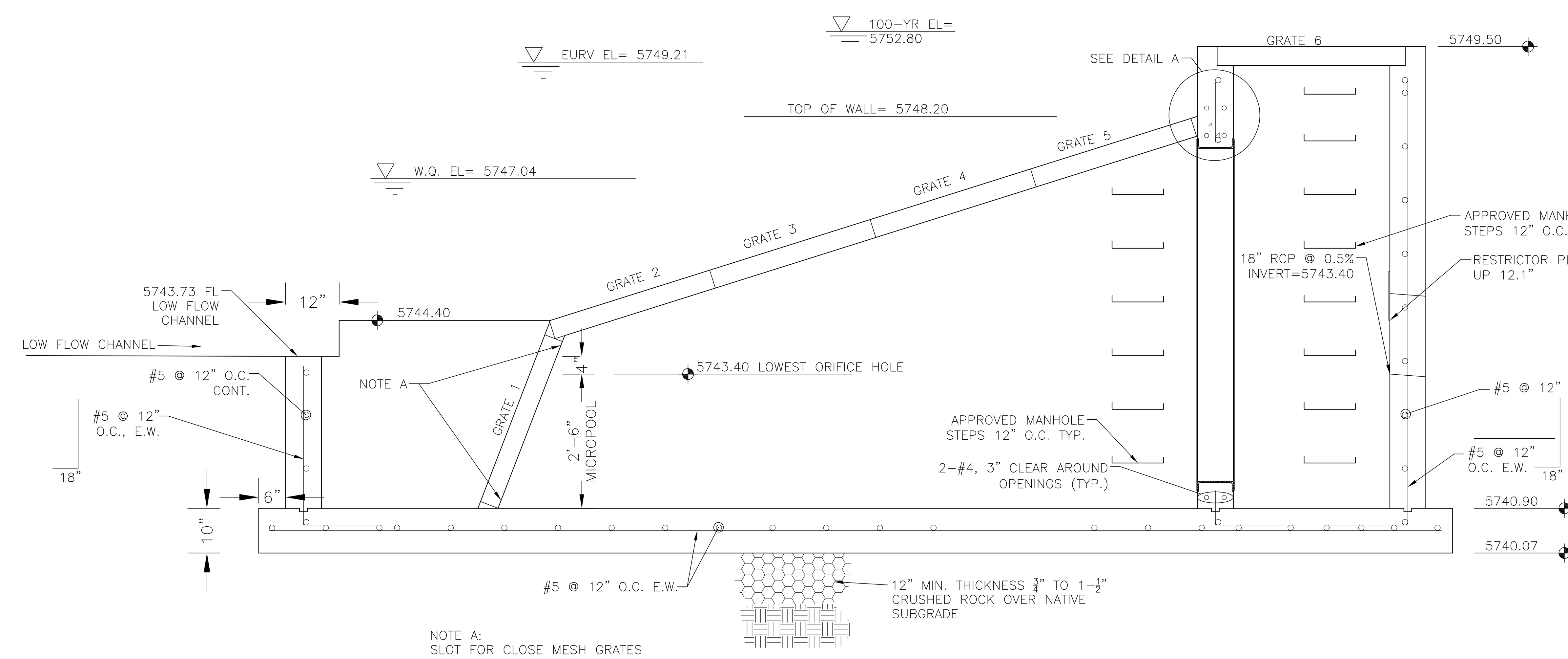
NOTE:
AFTER CONCRETE STRUCTURE HAS BEEN POURED ALL GRATE DIMENSIONS SHALL BE FIELD VERIFIED PRIOR TO GRATE CONSTRUCTION



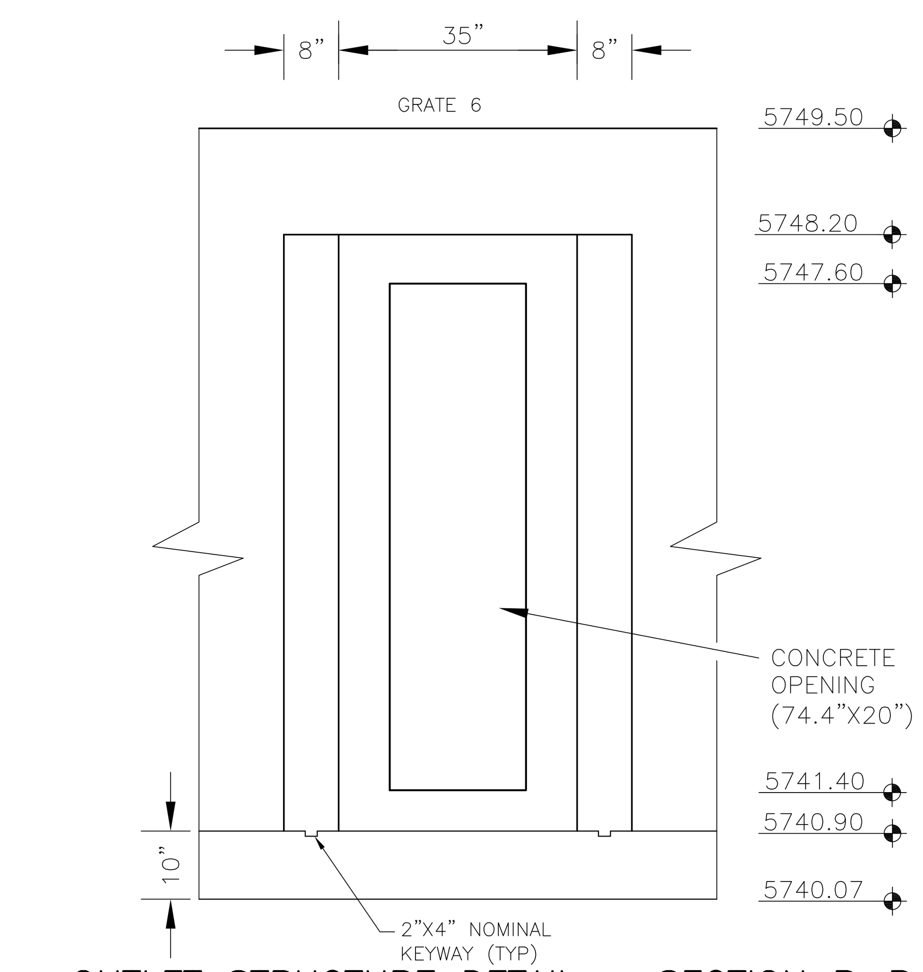
GRATE 1
NO SCALE



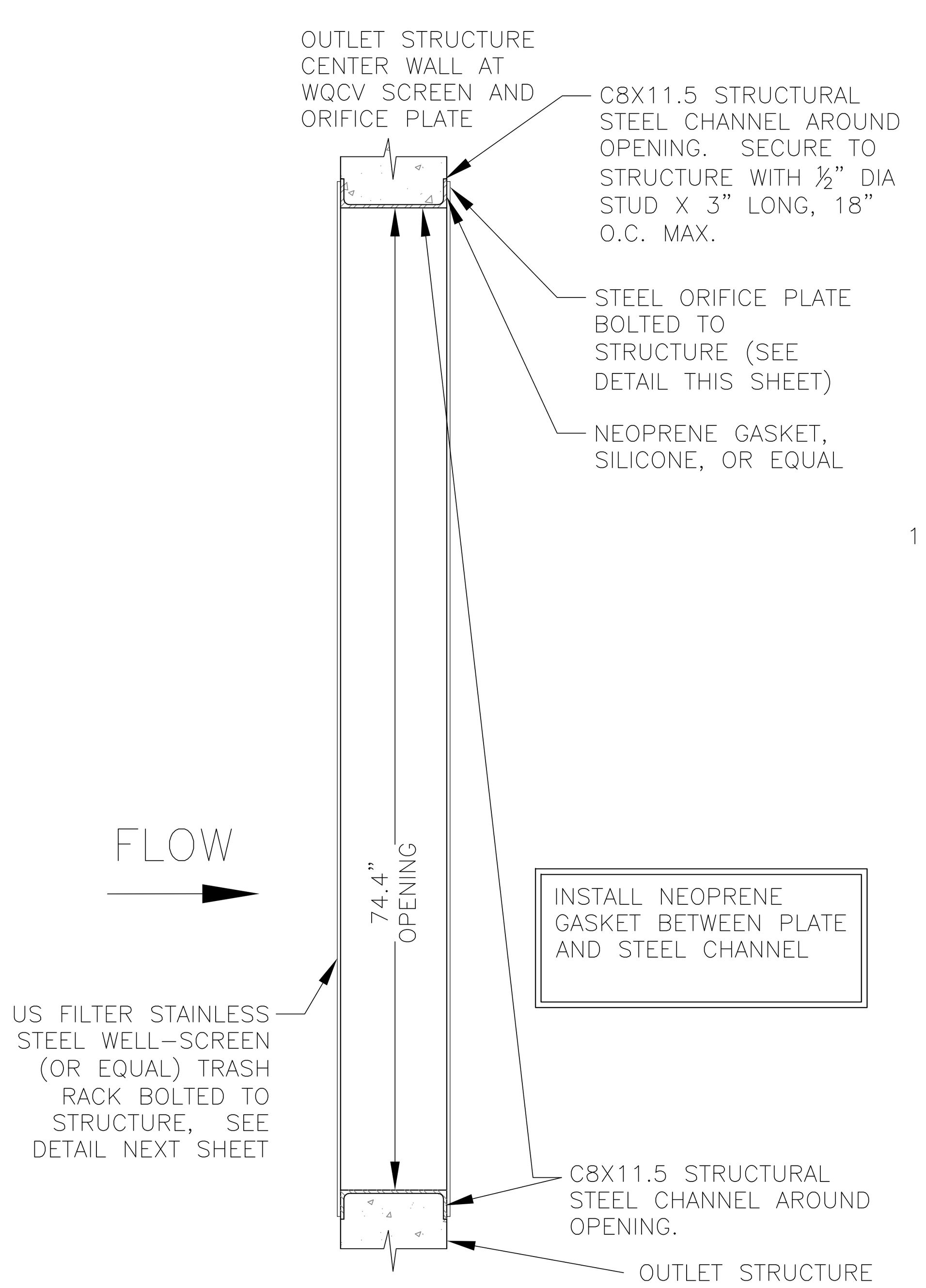
GRATES 2,3,4,5
NO SCALE



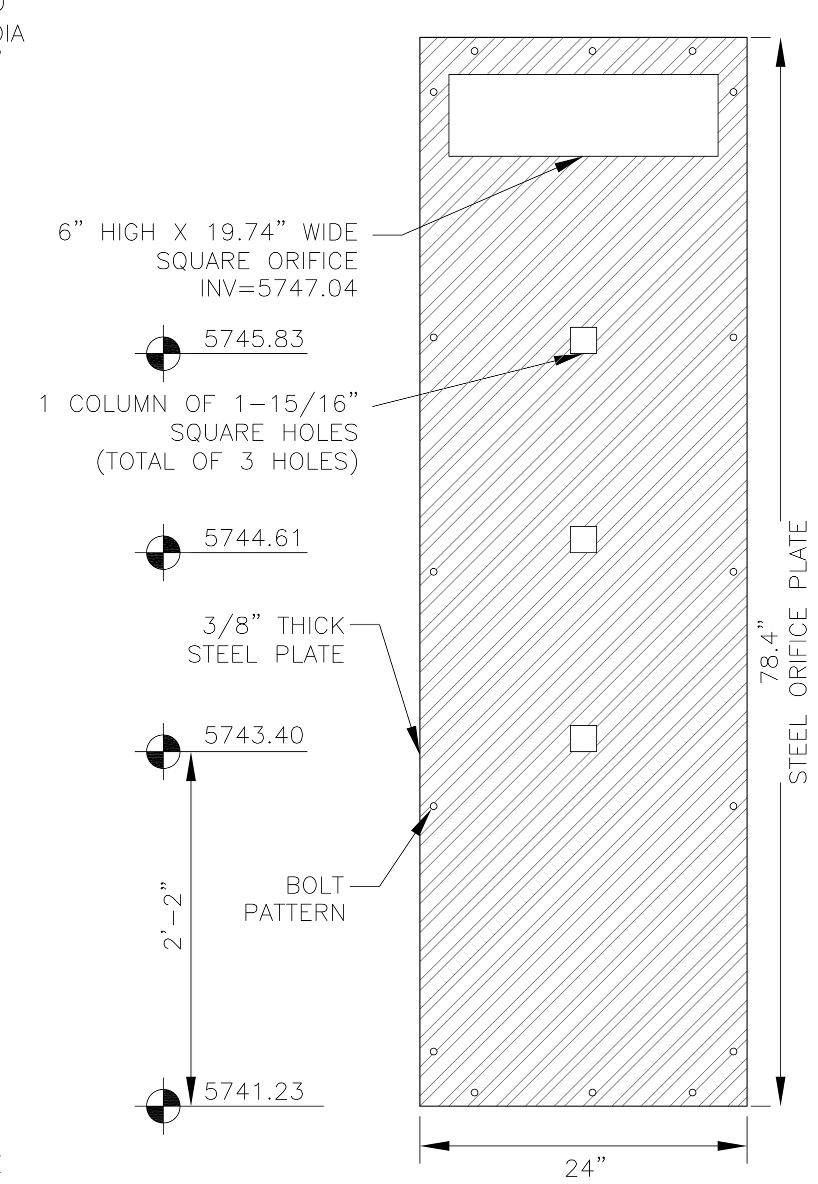
OUTLET STRUCTURE DETAIL – SECTION A-A
NO SCALE



OUTLET STRUCTURE DETAIL – SECTION B-B
NO SCALE



TRASH RACK DETAIL
NO SCALE



ORIFICE PLATE DETAIL
NO SCALE

OUTLET STRUCTURE, FOREBAY, AND DRAIN CHANNEL NOTES:

1. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL PROVIDE SHOP DRAWINGS FOR ALL COMPONENTS OF THE OUTLET STRUCTURE.
2. GRADE 60 REINFORCING STEEL REQUIRED. SEE TABLE FOR THE MINIMUM LAP SPLICE LENGTH FOR REINFORCING BARS. ALL REINFORCING STEEL SHALL HAVE A TWO-INCH MINIMUM CLEARANCE FROM EDGE OF CONCRETE, UNLESS OTHERWISE NOTED.

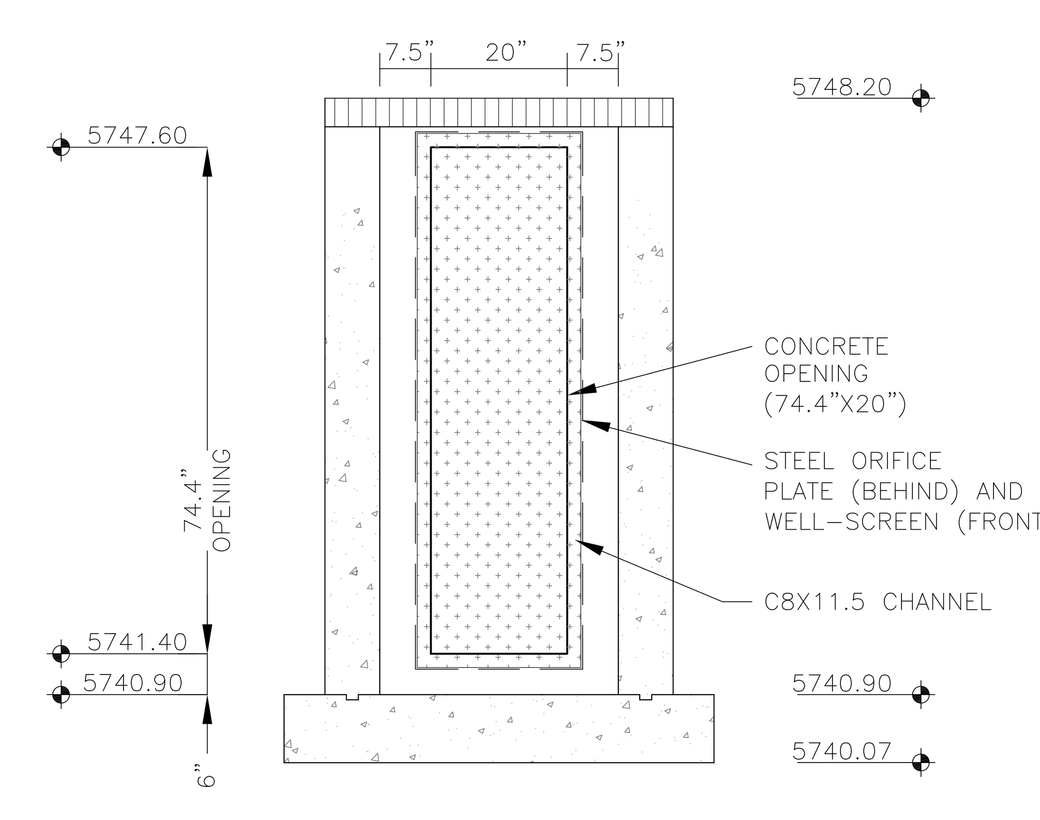
BAR SIZE	#4	#5	#6
MIN. SPLICE LENGTH	1'-3"	1'-7"	2'-0"

3. CONCRETE FOR THE OUTLET STRUCTURE AND FOREBAY SHALL BE CDOT CLASS D CONCRETE.
4. CONCRETE FOR DRAIN CHANNELS SHALL BE CDOT CLASS B CONCRETE
5. EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATION M-213. EXPANSION JOINT MATERIAL SHALL BE ½" THICK, SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE AND THE JOINT SHALL BE SEALED, REFER TO DETAILS.
6. ALL EXPOSED CONCRETE CORNERS SHALL HAVE A ¾" CHAMFER UNLESS OTHERWISE NOTED.
7. SUBGRADE TO BE 12" THICK CLEAN FILL COMPACTED TO 95% STANDARD PROCTOR DENSITY PER ASTM M698 UNDER STRUCTURE.
8. REFER TO POND DETAILS FOR PRESEDIMENTATION/FOREBAY DESIGN.
9. ENGINEER SHALL BE NOTIFIED PRIOR TO BEGINNING CONSTRUCITON OF OUTLET STRUCTURE TO SCHEDULE OBSERVATION VISITS FOR STRUCTURES.

WQCV WELL-SCREEN NOTES:

1. Well-Screen shall be stainless steel and attached by stainless steel bolts along edge of the mounting frame.

2. WQCV Well Screen
- Type of Screen: Stainless steel #93 Vee Wire (Johnson Vee Wire (tm) Stainless Steel Screen or equivalent with 60% open area)
- Screen slot opening dimension: 0.139" (Screen #93 Vee Wire Slot Opening)
- Type and Size of Support Rod: TE 0.074"X0.50"
- Spacing of Support Rod (O.C.): 1.0 Inch
- Total Screen Thickness: 0.655"
- Carbon Steel Holding Frame Type: 3/4" x 1.0" angle



OUTLET STRUCTURE DETAIL – SECTION B-B
NO SCALE

CORE ENGINEERING GROUP
15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

NO. | DATE | DESCRIPTION

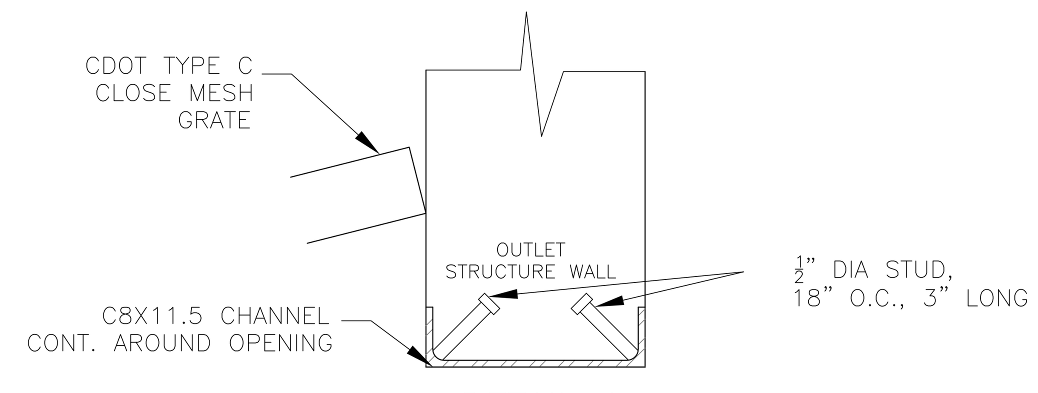
PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS COLLECTOR STREET CONSTRUCTION
FONTAINE BLVD – GRAYLING DR
LORSON BLVD–WALLEYE DR–LAMPREY DR
COLORADO SPRINGS, COLORADO

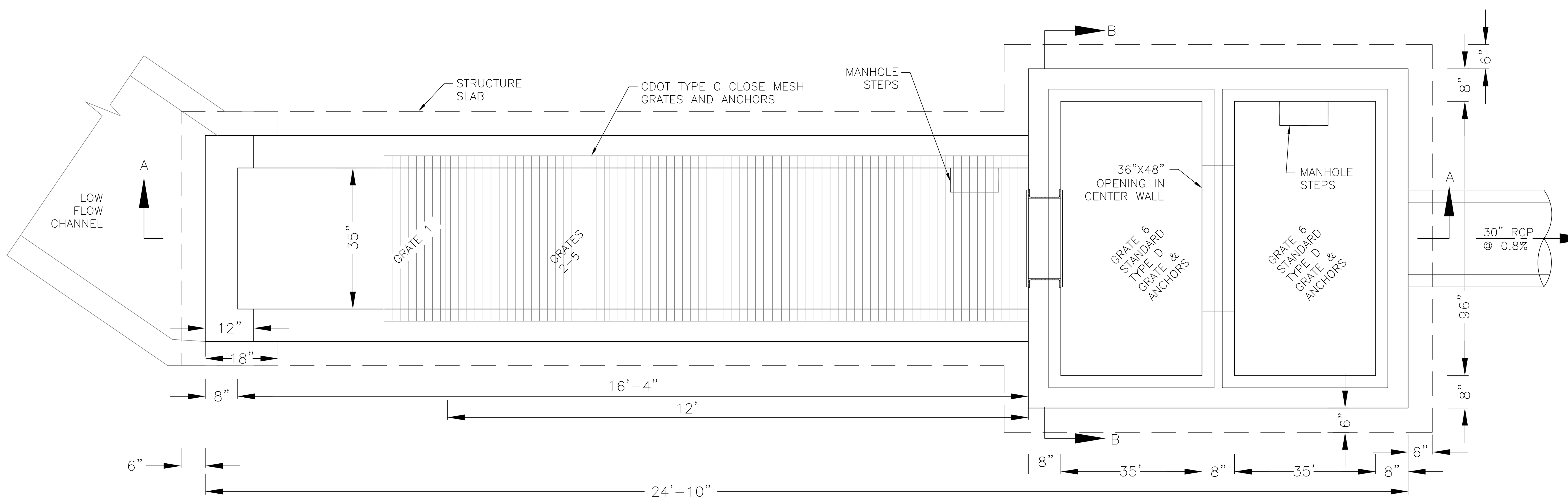
DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

POND C1
FULL SPECTRUM
OUTLET STRUCTURE DETAILS

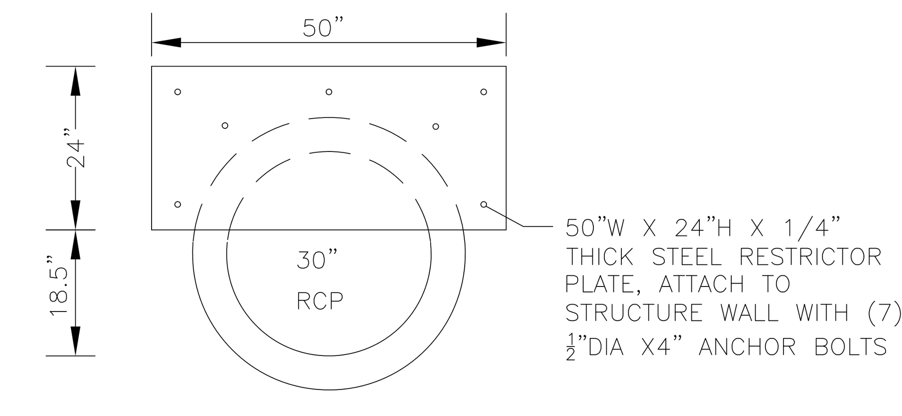
DATE: OCT 22, 2020
PROJECT NO. 100.061
SHEET NUMBER C9.12
TOTAL SHEETS: 58



DETAIL A
NO SCALE

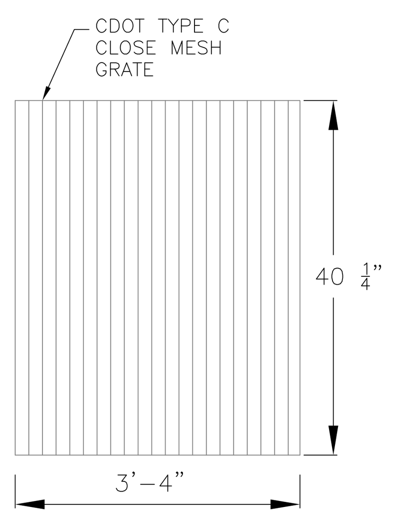


OUTLET STRUCTURE DETAIL – PLAN VIEW
NO SCALE

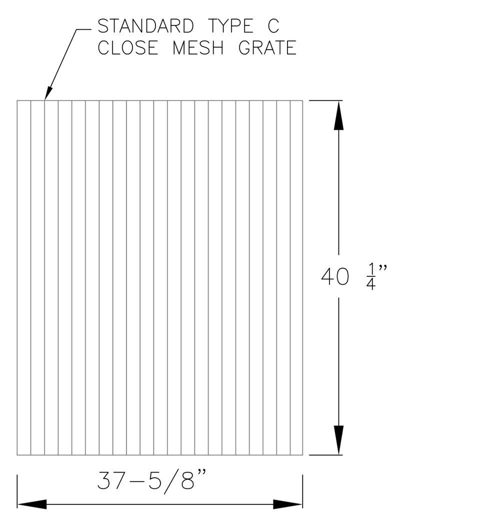


OUTLET RESTRICTOR PLATE
NO SCALE

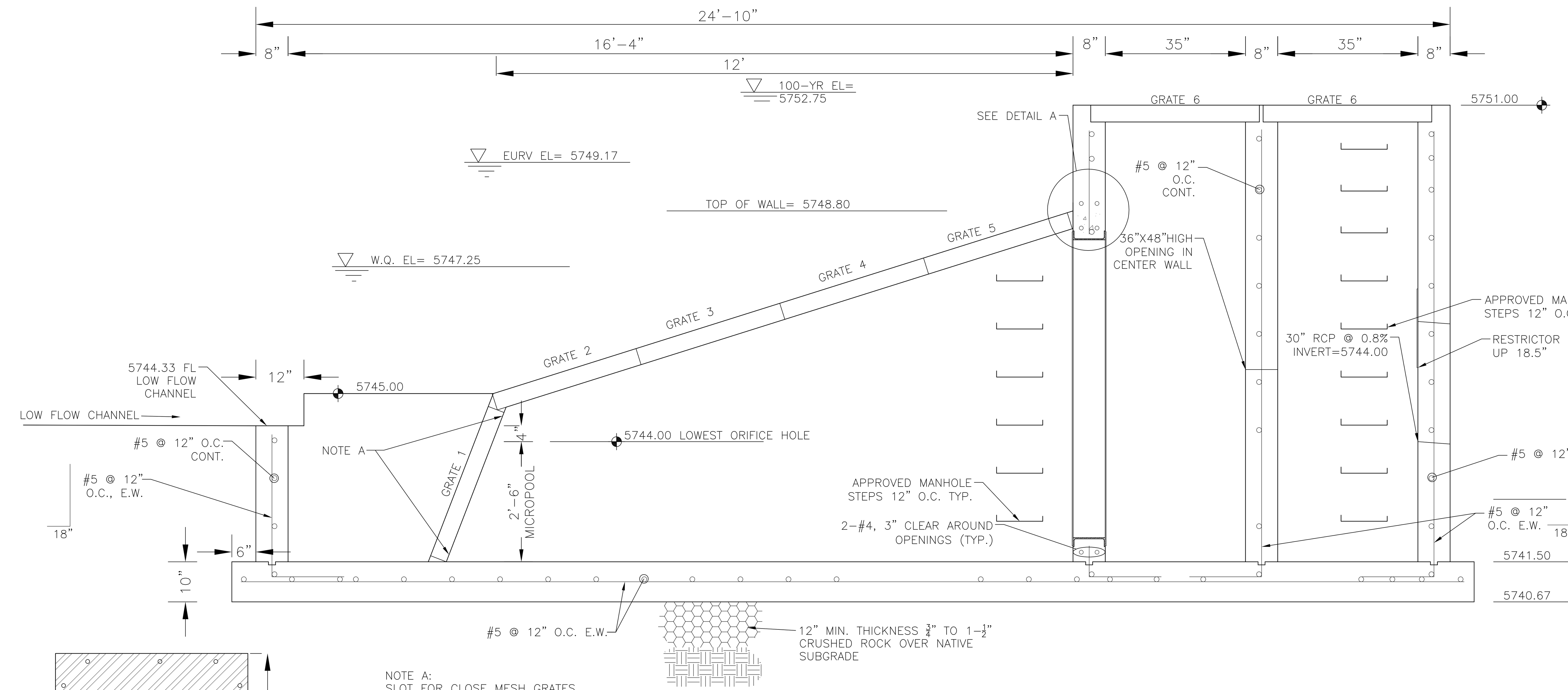
NOTE:
AFTER CONCRETE STRUCTURE HAS BEEN POURED
ALL GRATE DIMENSIONS SHALL BE FIELD VERIFIED
PRIOR TO GRATE CONSTRUCTION



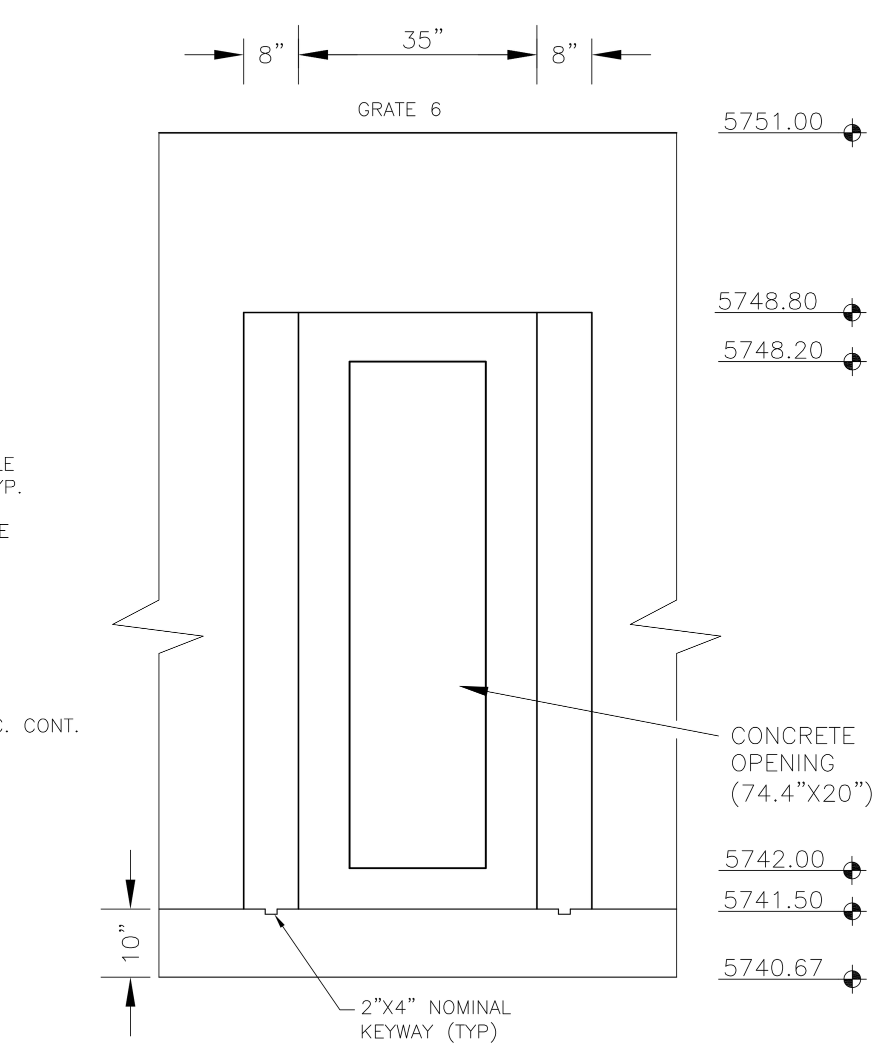
GRATE 1
NO SCALE



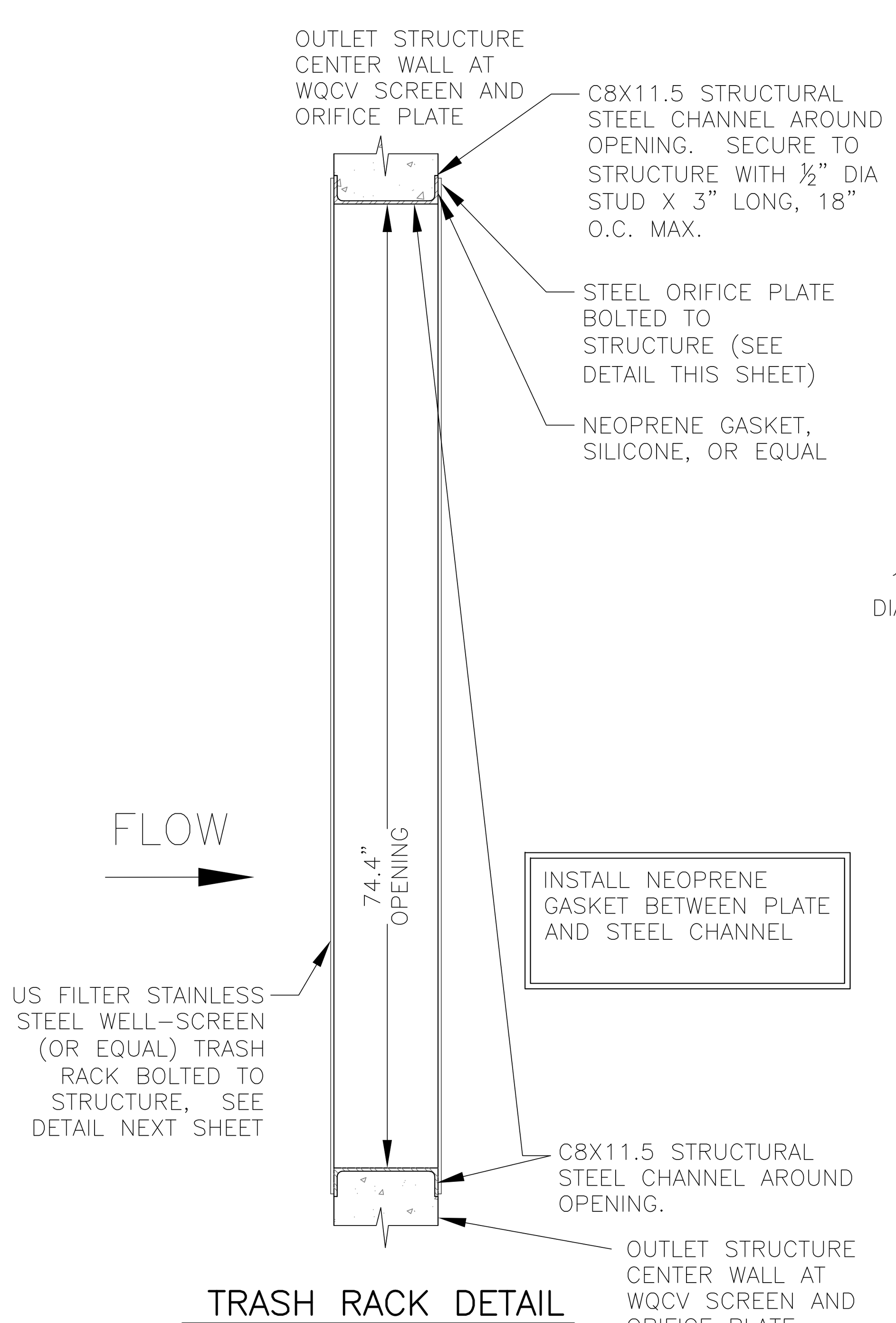
GRATES 2,3,4,5
NO SCALE



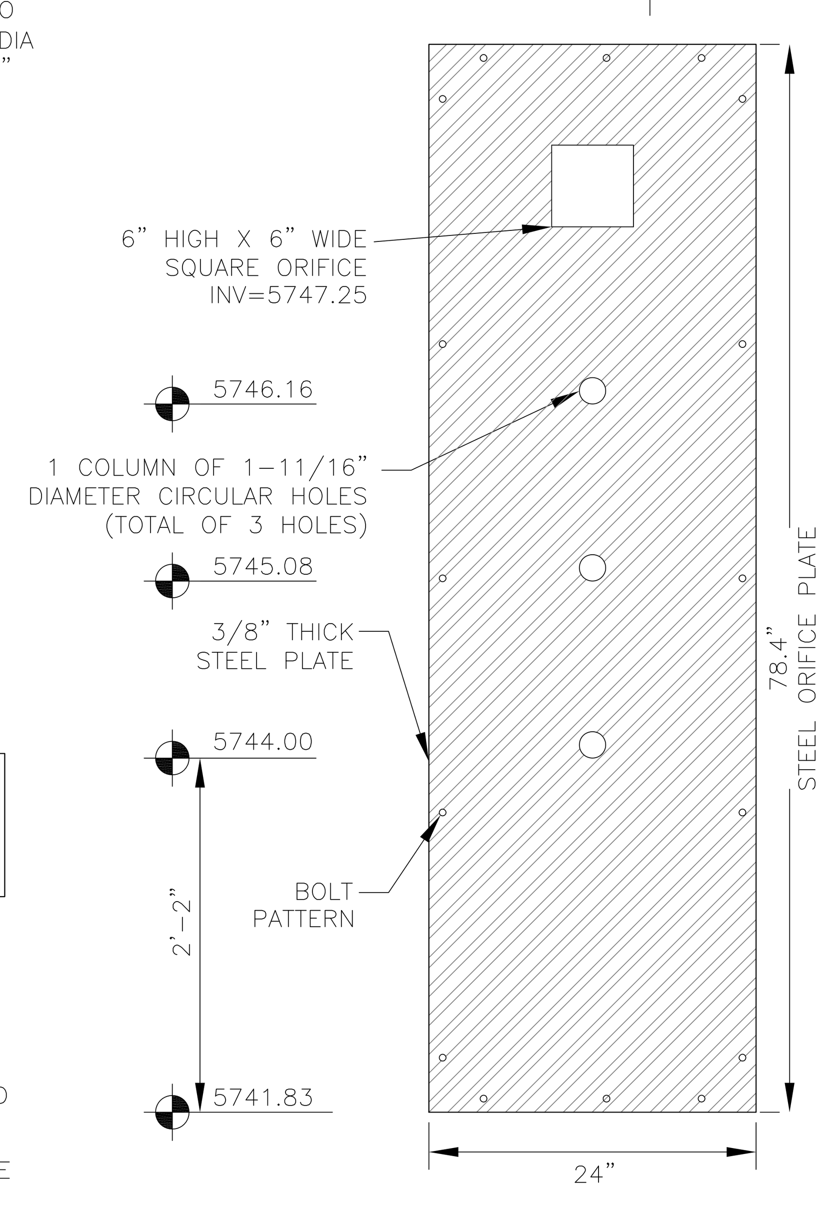
OUTLET STRUCTURE DETAIL – SECTION A-A
NO SCALE



OUTLET STRUCTURE DETAIL – SECTION B-B
NO SCALE



TRASH RACK DETAIL
NO SCALE



ORIFICE PLATE DETAIL
NO SCALE

OUTLET STRUCTURE, FOREBAY, AND DRAIN CHANNEL NOTES:

1. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL PROVIDE SHOP DRAWINGS FOR ALL COMPONENTS OF THE OUTLET STRUCTURE.
2. GRADE 60 REINFORCING STEEL REQUIRED. SEE TABLE FOR THE MINIMUM LAP SPLICE LENGTH FOR REINFORCING BARS. ALL REINFORCING STEEL SHALL HAVE A TWO-INCH MINIMUM CLEARANCE FROM EDGE OF CONCRETE, UNLESS OTHERWISE NOTED.

BAR SIZE	#4	#5	#6
MIN. SPLICE LENGTH	1'-3"	1'-7"	2'-0"

3. CONCRETE FOR THE OUTLET STRUCTURE AND FOREBAY SHALL BE CDOT CLASS D CONCRETE.
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5. EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATION M-213. EXPANSION JOINT MATERIAL SHALL BE ½" THICK, SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE AND THE JOINT SHALL BE SEALED, REFER TO DETAILS.
6. ALL EXPOSED CONCRETE CORNERS SHALL HAVE A ⅜" CHAMFER UNLESS OTHERWISE NOTED.
7. SUBGRADE TO BE 12" THICK CLEAN FILL COMPACTED TO 95% STANDARD PROCTOR DENSITY PER ASTM M698 UNDER STRUCTURE.
8. REFER TO POND DETAILS FOR PRESEDIMENTATION/FOREBAY DESIGN.
9. ENGINEER SHALL BE NOTIFIED PRIOR TO BEGINNING CONSTRUCITON OF OUTLET STRUCTURE TO SCHEDULE OBSERVATION VISITS FOR STRUCTURES.

WQCV WELL-SCREEN NOTES:

1. Well-Screen shall be stainless steel and attached by stainless steel bolts along edge of the mounting frame.

2. WQCV Well Screen
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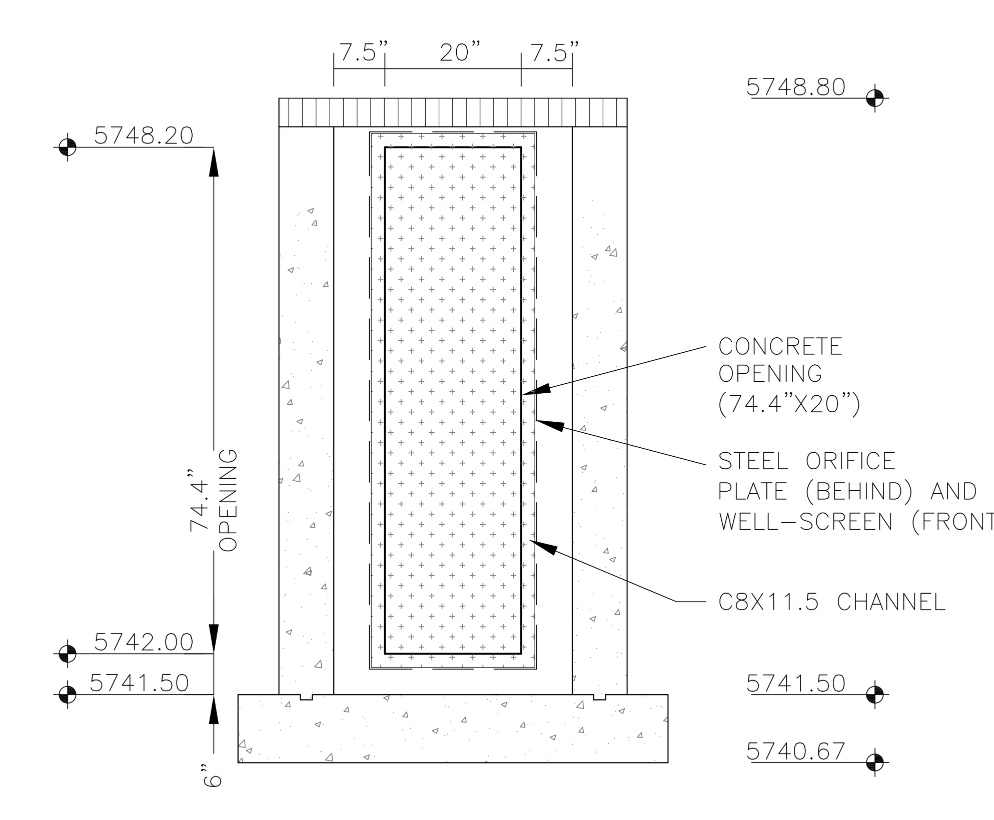
- Screen slot opening dimension: 0.139" (Screen #93 Vee Wire Slot Opening)
- Type and Size of Support Rod: TE 0.074"X0.50"
- Spacing of Support Rod (O.C.): 1.0 Inch
- Total Screen Thickness: 0.655"
- Carbon Steel Holding Frame Type: 3/4" x 1.0" angle



OUTLET STRUCTURE DETAIL – SECTION B-B
NO SCALE

CORE
ENGINEERING GROUP
15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

NO.	DESCRIPTION	DATE

PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS COLLECTOR STREET CONSTRUCTION
FONTAINE BLVD - GRAYLING DR
LORSON BLVD-WALLEYE DR-LAMPREY DR
COLORADO SPRINGS, COLORADO

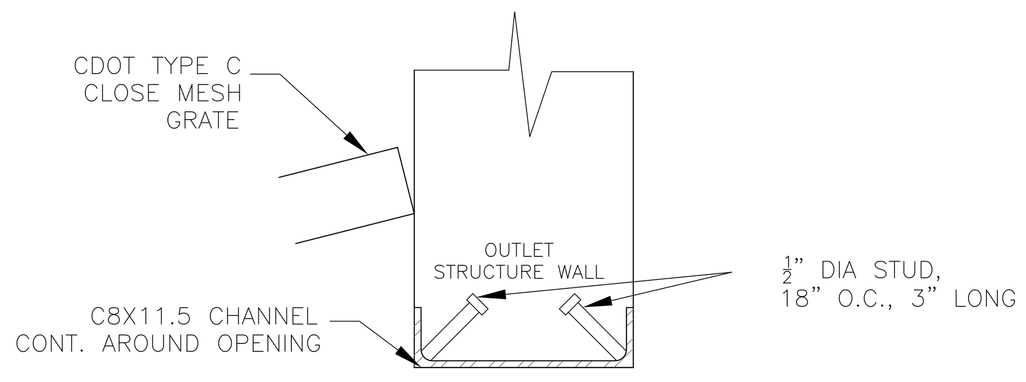
DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

POND C2.2
FULL SPECTRUM
OUTLET STRUCTURE DETAILS

DATE:
OCT 22, 2020

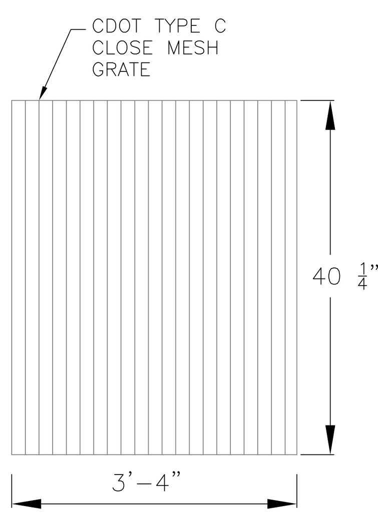
PROJECT NO.
100.061

SHEET NUMBER
C9.13
TOTAL SHEETS: 58

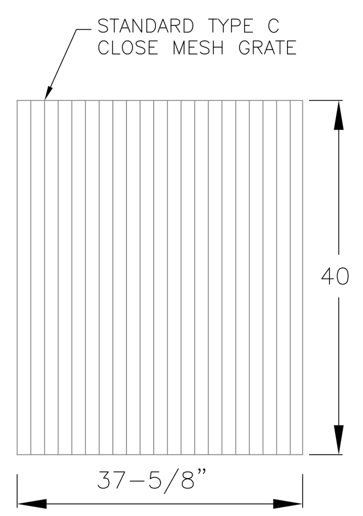


DETAIL A
NO SCALE

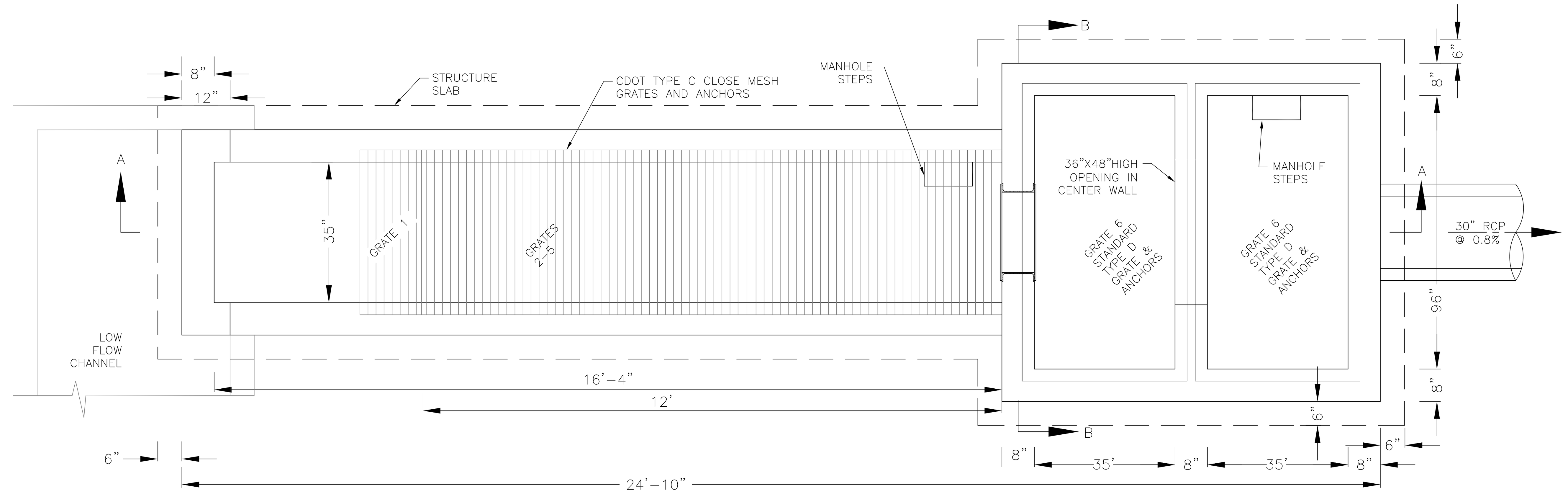
NOTE:
AFTER CONCRETE STRUCTURE HAS BEEN POURED
ALL GRATE DIMENSIONS SHALL BE FIELD VERIFIED
PRIOR TO GRATE CONSTRUCTION



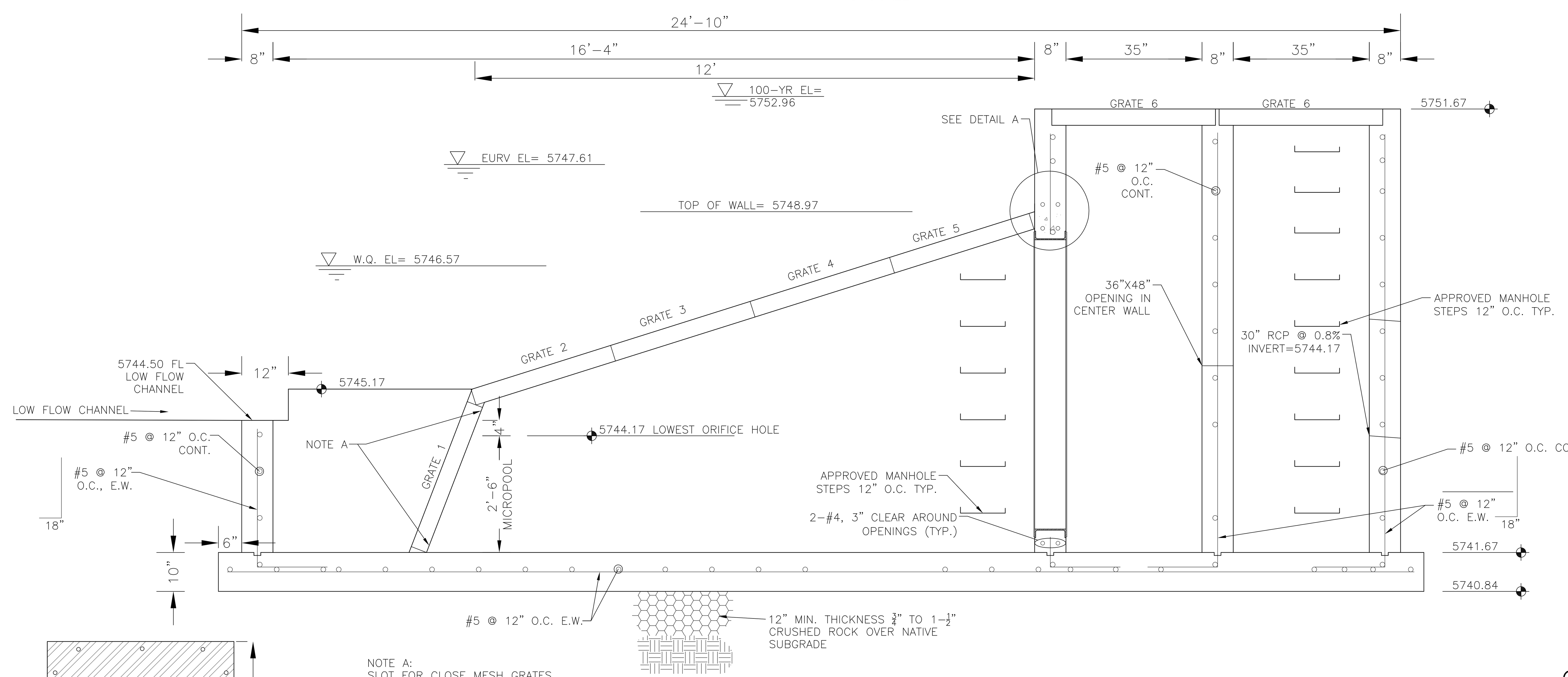
GRATE 1
NO SCALE



GRATES 2,3,4,5
NO SCALE

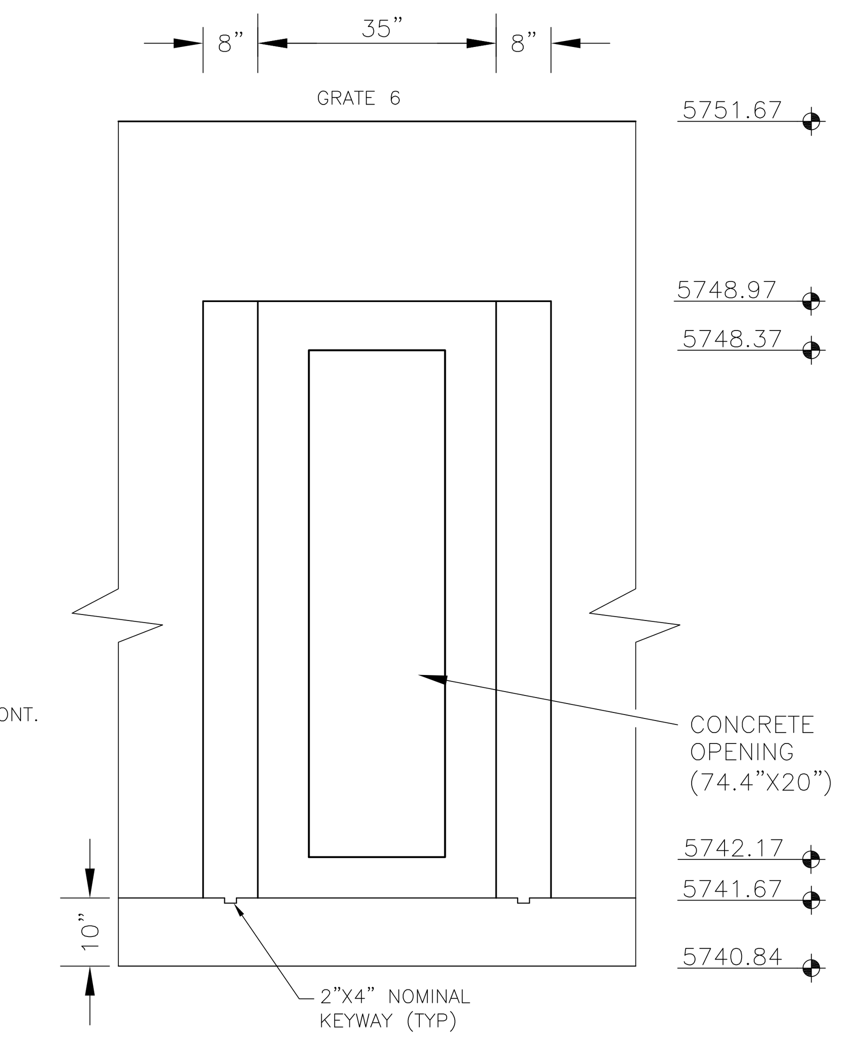


OUTLET STRUCTURE DETAIL – PLAN VIEW
NO SCALE

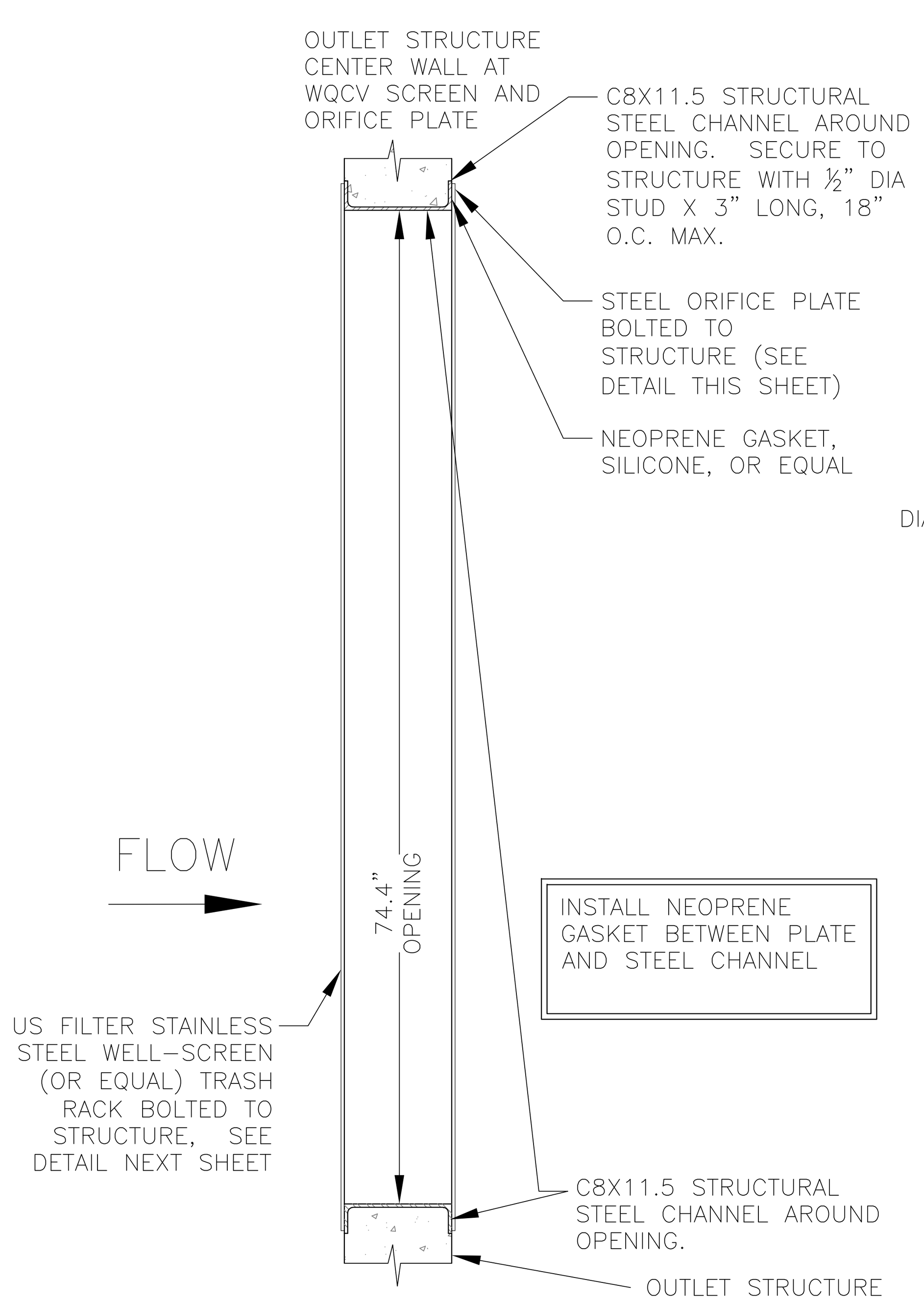


NOTE A:
SLOT FOR CLOSE MESH GRATES

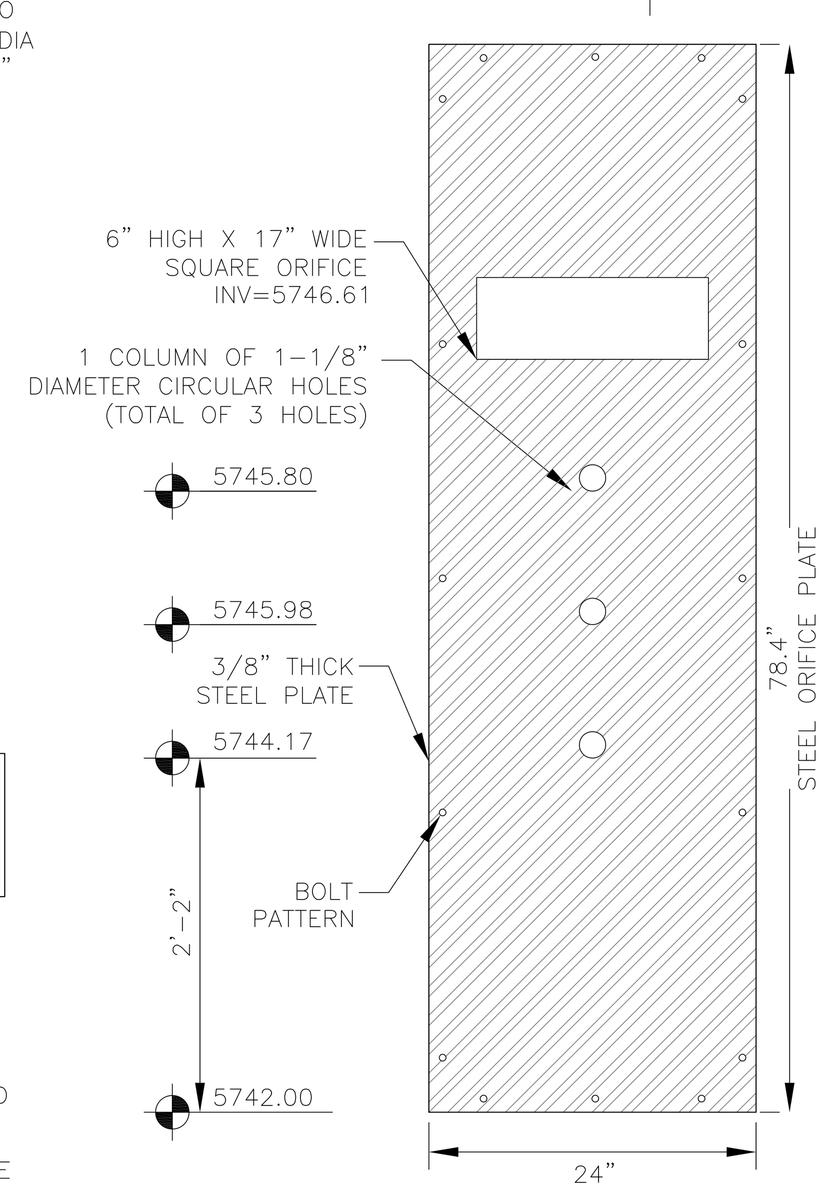
OUTLET STRUCTURE DETAIL – SECTION A–A
NO SCALE



OUTLET STRUCTURE DETAIL – SECTION B–B
NO SCALE



TRASH RACK DETAIL
NO SCALE



ORIFICE PLATE DETAIL
NO SCALE

OUTLET STRUCTURE, FOREBAY, AND DRAIN CHANNEL NOTES:

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9. ENGINEER SHALL BE NOTIFIED PRIOR TO BEGINNING CONSTRUCITON OF OUTLET STRUCTURE TO SCHEDULE OBSERVATION VISITS FOR STRUCTURES.

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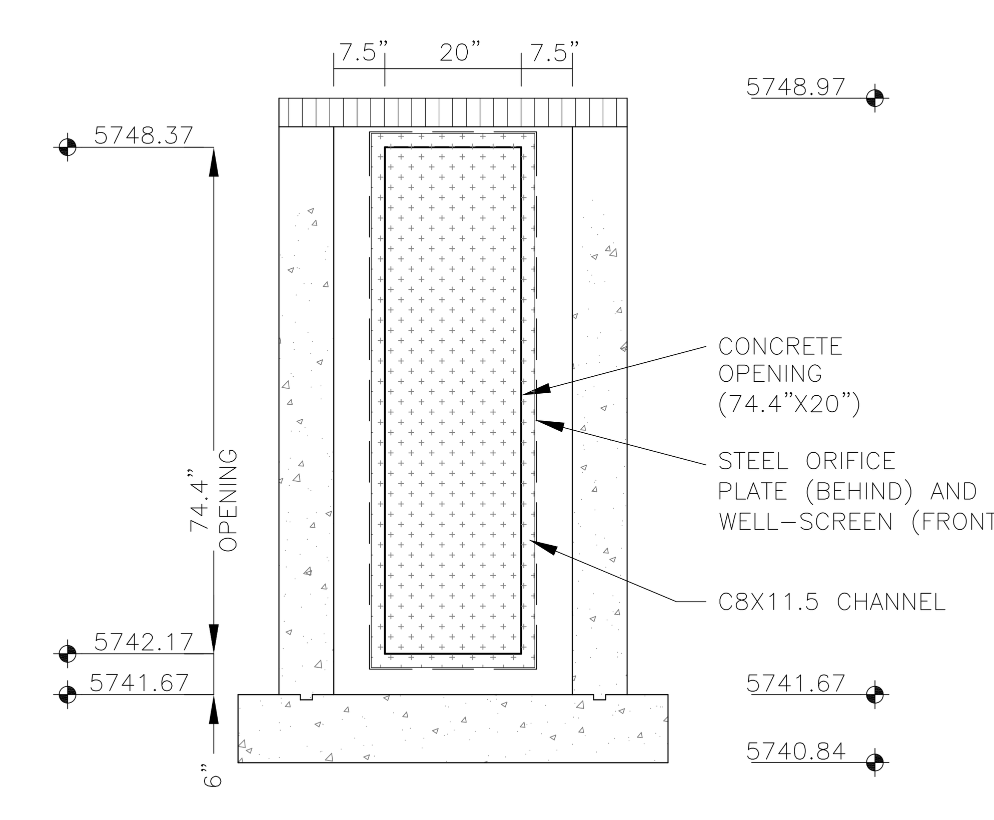
- Spacing of Support Rod (O.C.): 1.0 Inch
- Total Screen Thickness: 0.655"
- Carbon Steel Holding Frame Type: 3/4" x 1.0" angle



OUTLET STRUCTURE DETAIL – SECTION B–B
NO SCALE

CORE
ENGINEERING GROUP
15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

NO.	DESCRIPTION	DATE

PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS COLLECTOR
STREET CONSTRUCTION
FONTAINE BLVD – GRAYLING DR
LORSON BLVD-WALLEYE DR-LAMPREY DR
COLORADO SPRINGS, COLORADO

DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

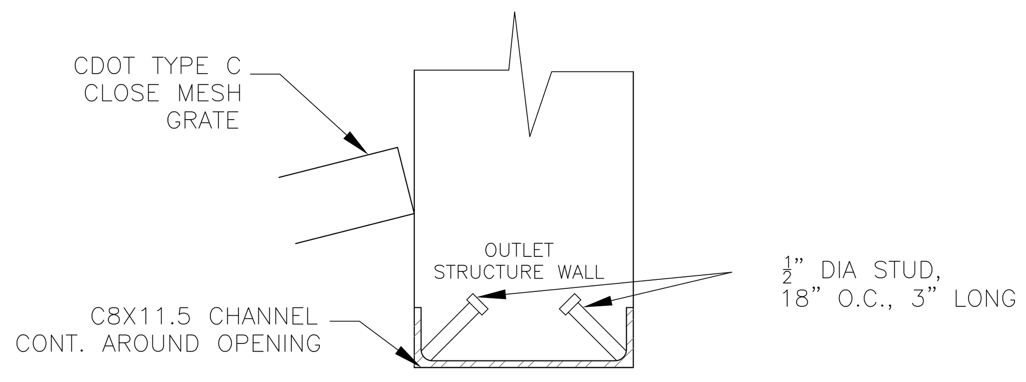
POND C2.3
FULL SPECTRUM
OUTLET STRUCTURE DETAILS

DATE:
OCT 22, 2020

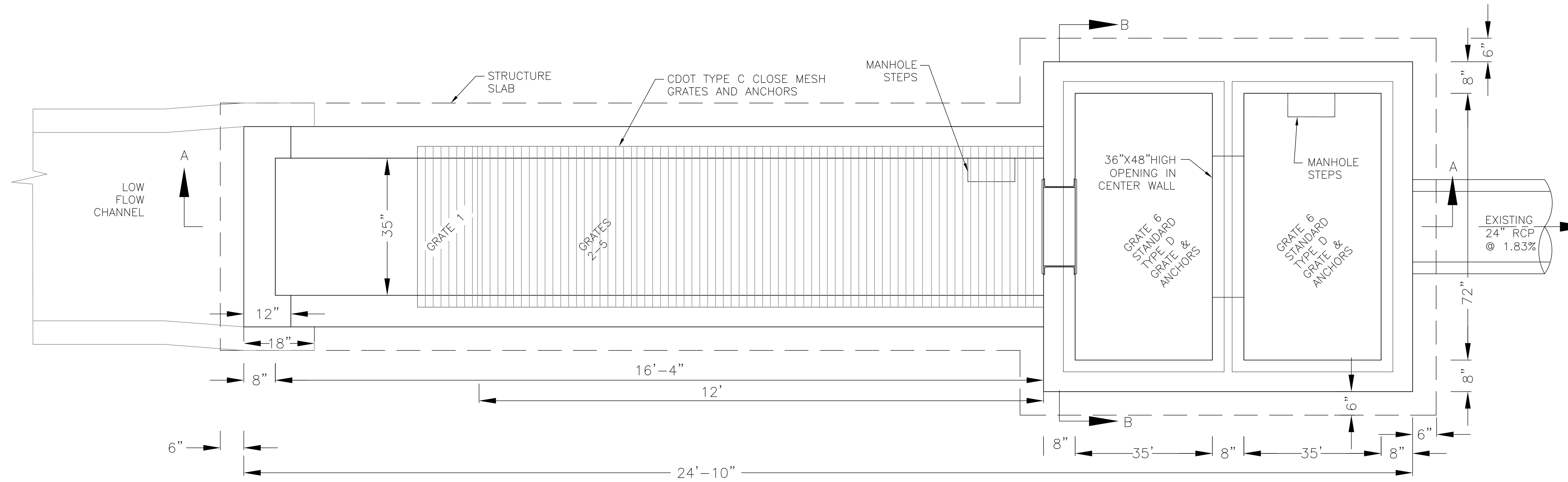
PROJECT NO.
100.061

SHEET NUMBER
C9.14

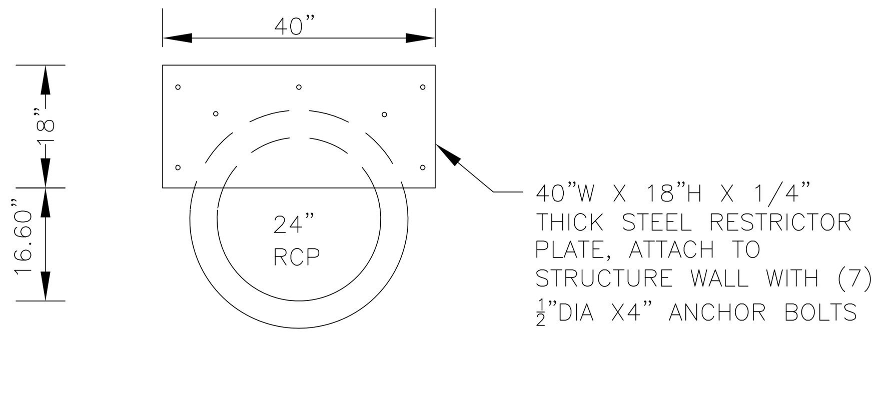
TOTAL SHEETS: 58



DETAIL A
NO SCALE

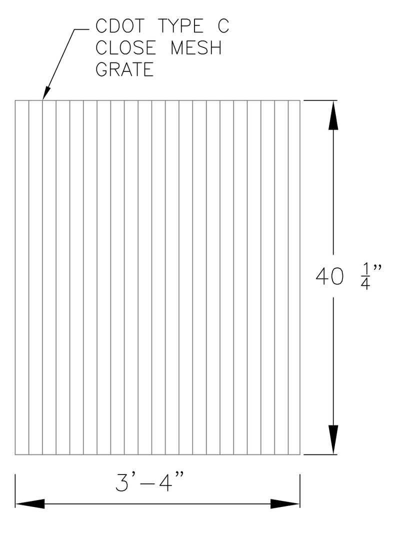


OUTLET STRUCTURE DETAIL – PLAN VIEW
NO SCALE

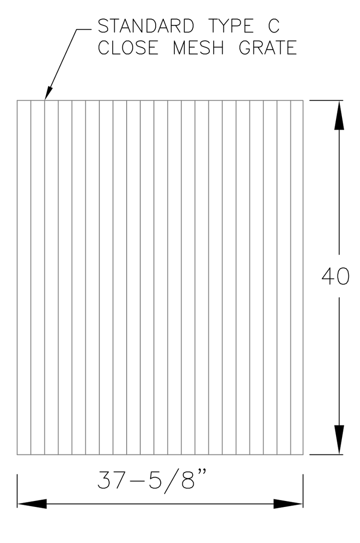


OUTLET RESTRICTOR PLATE
NO SCALE

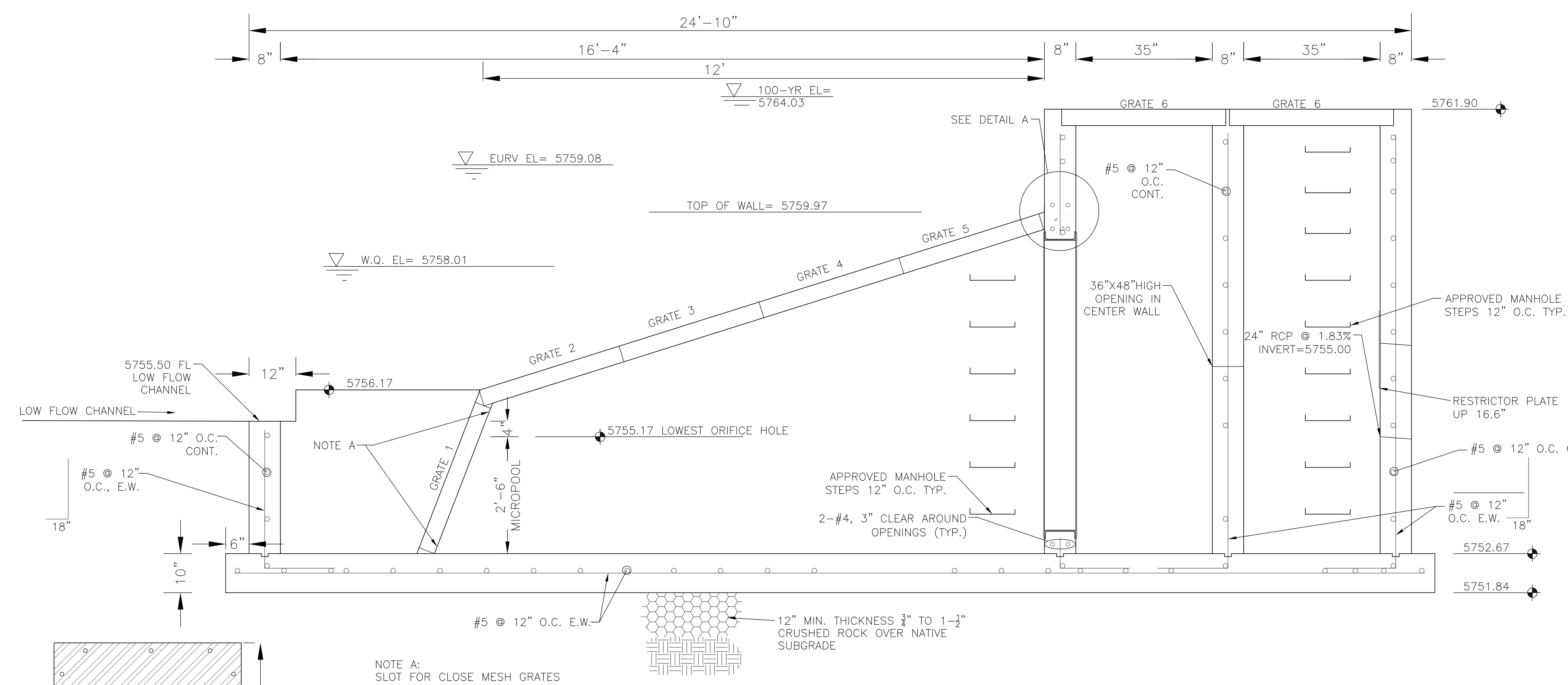
NOTE:
AFTER CONCRETE STRUCTURE HAS BEEN POURED ALL GRATE DIMENSIONS SHALL BE FIELD VERIFIED PRIOR TO GRATE CONSTRUCTION



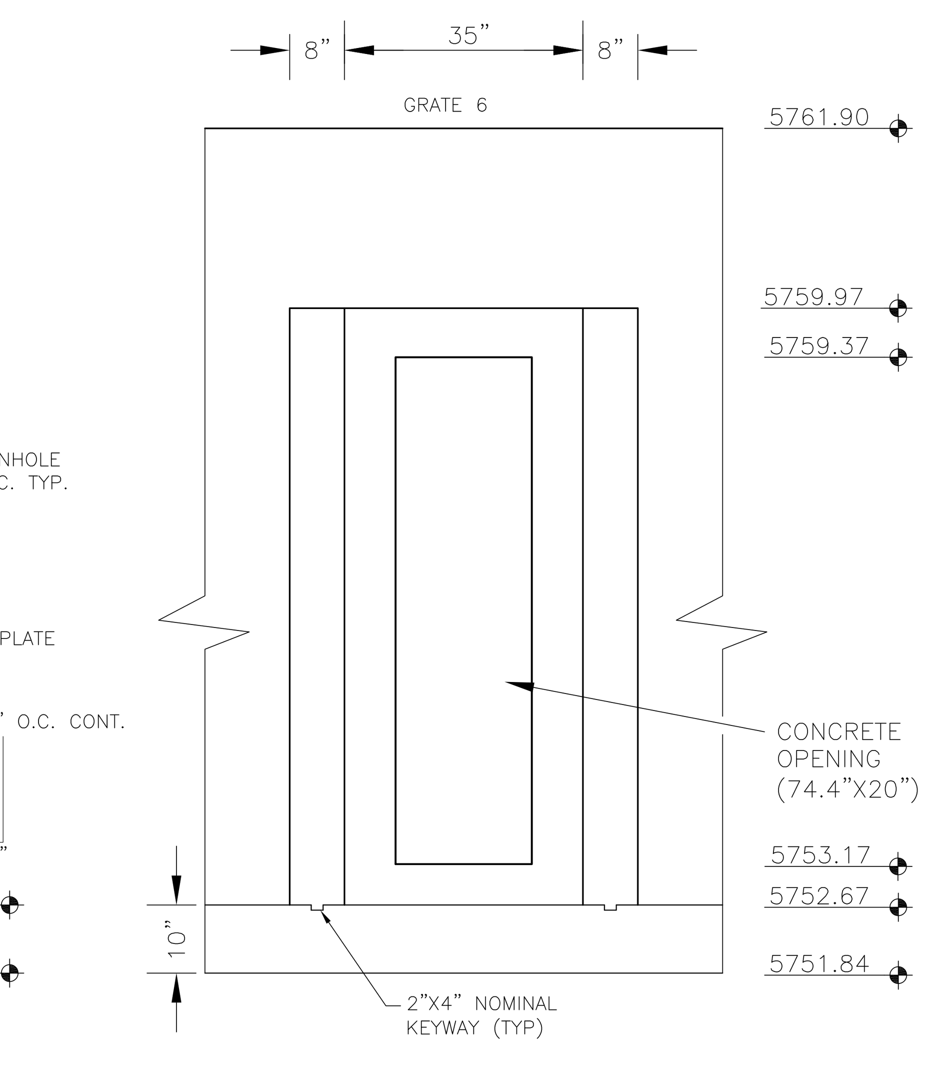
GRATE 1
NO SCALE



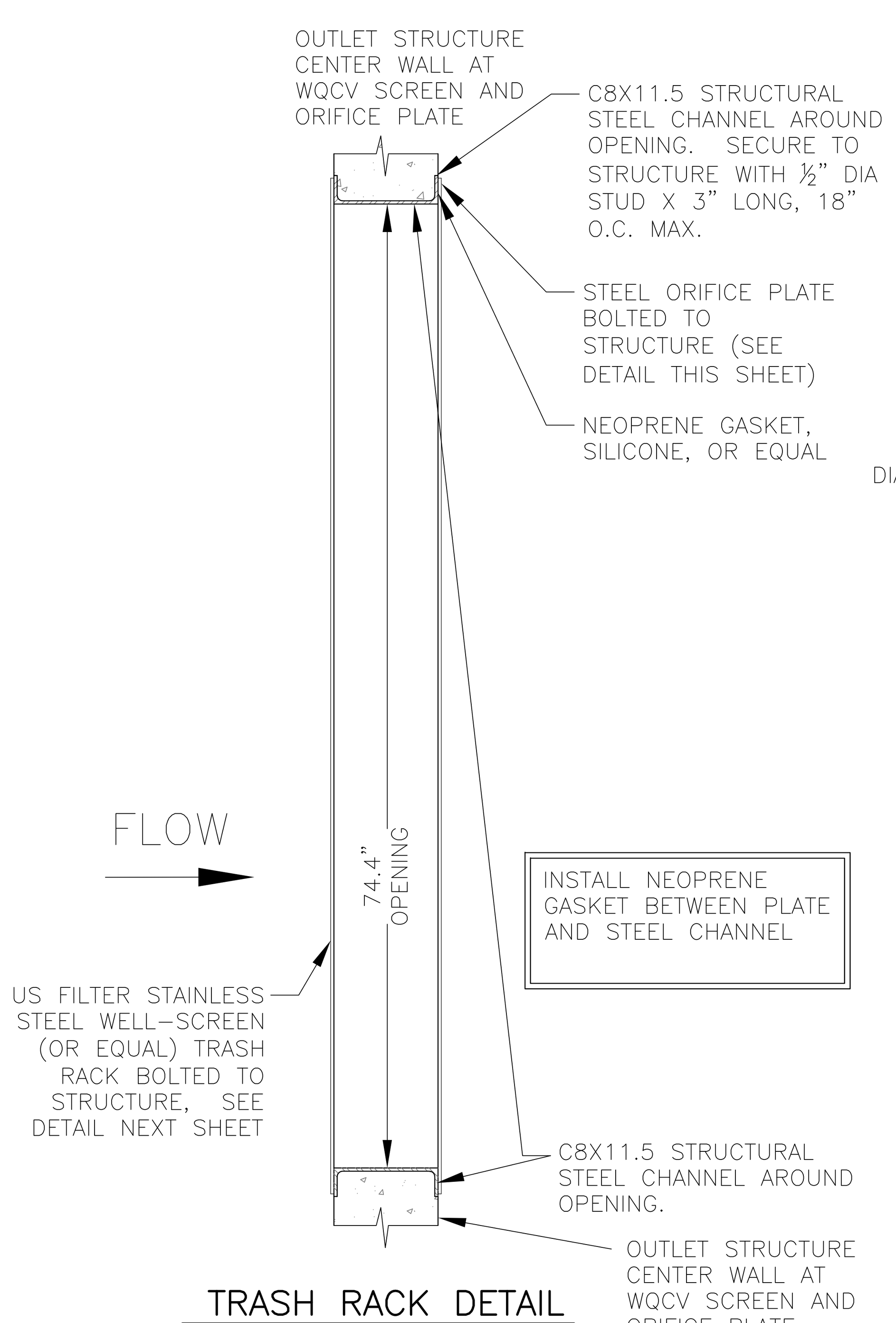
GRATES 2,3,4,5
NO SCALE



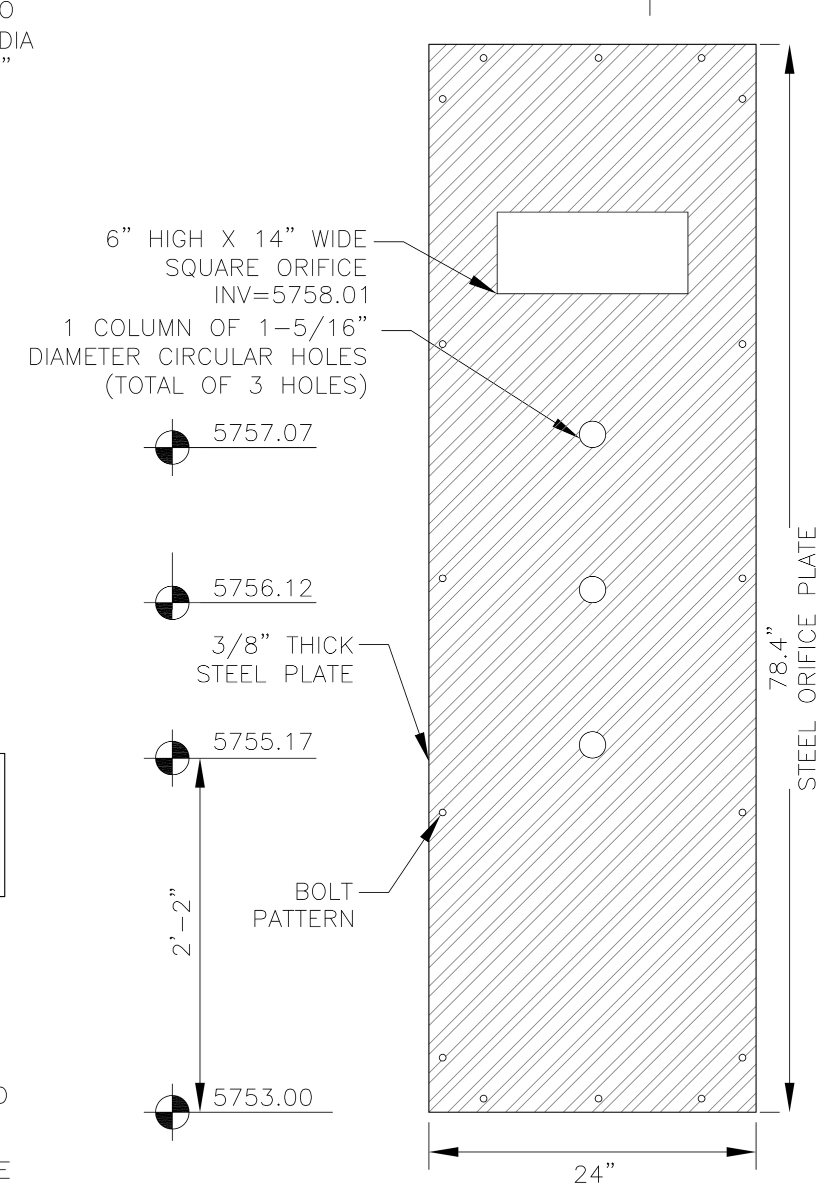
OUTLET STRUCTURE DETAIL – SECTION A-A
NO SCALE



OUTLET STRUCTURE DETAIL – SECTION B-B
NO SCALE



TRASH RACK DETAIL
NO SCALE



ORIFICE PLATE DETAIL
NO SCALE

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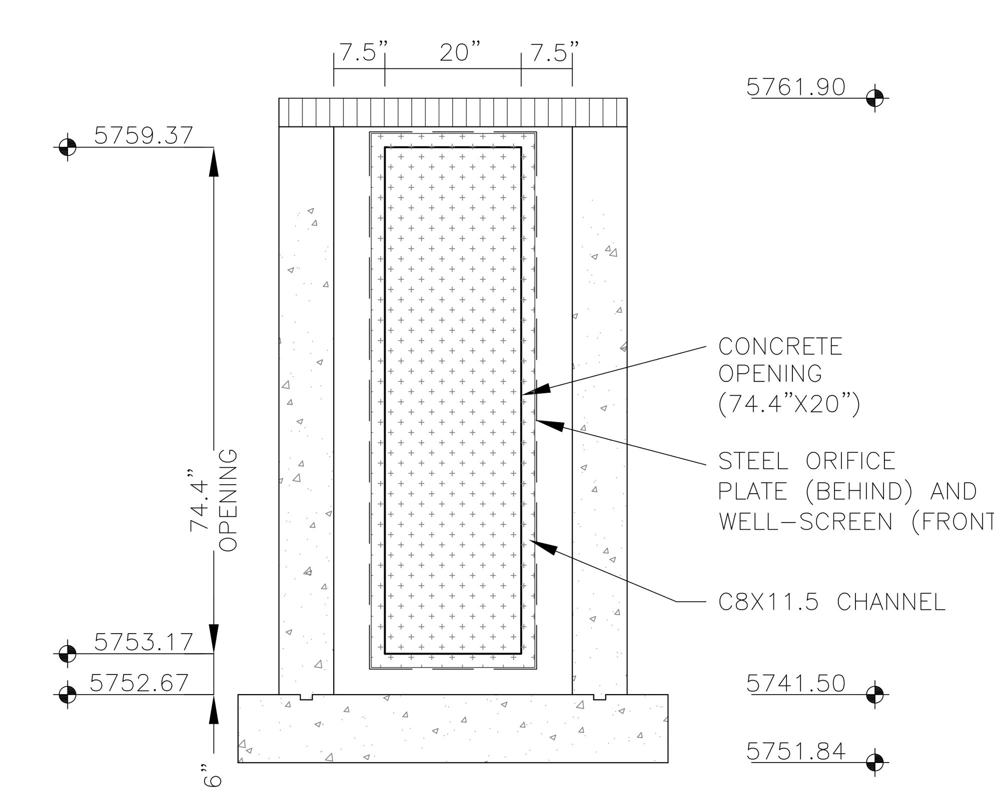


OUTLET STRUCTURE DETAIL – SECTION B-B
NO SCALE

CORE ENGINEERING GROUP
15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

NO.	DESCRIPTION	DATE

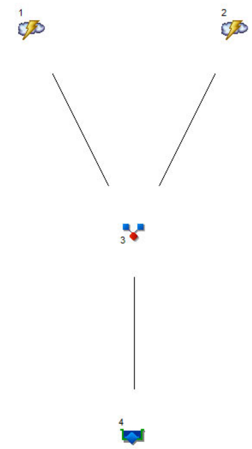
PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS COLLECTOR STREET CONSTRUCTION
FONTAINE BLVD - GRAYLING DR
LORSON BLVD-WALLEYE DR-LAMPREY DR
COLORADO SPRINGS, COLORADO

DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

POND C3
FULL SPECTRUM
OUTLET STRUCTURE DETAILS

DATE: OCT 22, 2020
PROJECT NO. 100.061
SHEET NUMBER C9.15
TOTAL SHEETS: 58



Legend

Hyd.	**Origin**	**Description**
1	Rational	Basin C4.2-ex
2	Rational	Basins C4.1-ex
3	Combine	Pond C4 interim inflow
4	Reservoir	Pond C4 Interim Outflo

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	19.25	1	21	24,254	----	------	------	Basin C4.2-ex
2	Rational	1.356	1	21	1,709	----	------	------	Basins C4.1-ex
3	Combine	20.61	1	21	25,962	1, 2	------	------	Pond C4 interim inflow
4	Reservoir	10.26	1	32	25,962	3	5766.47	10,139	Pond C4 Interim Outflo

pond c4 existing-5yr.gpw	Return Period: 5 Year	Monday, May 18 2020, 4:07 PM

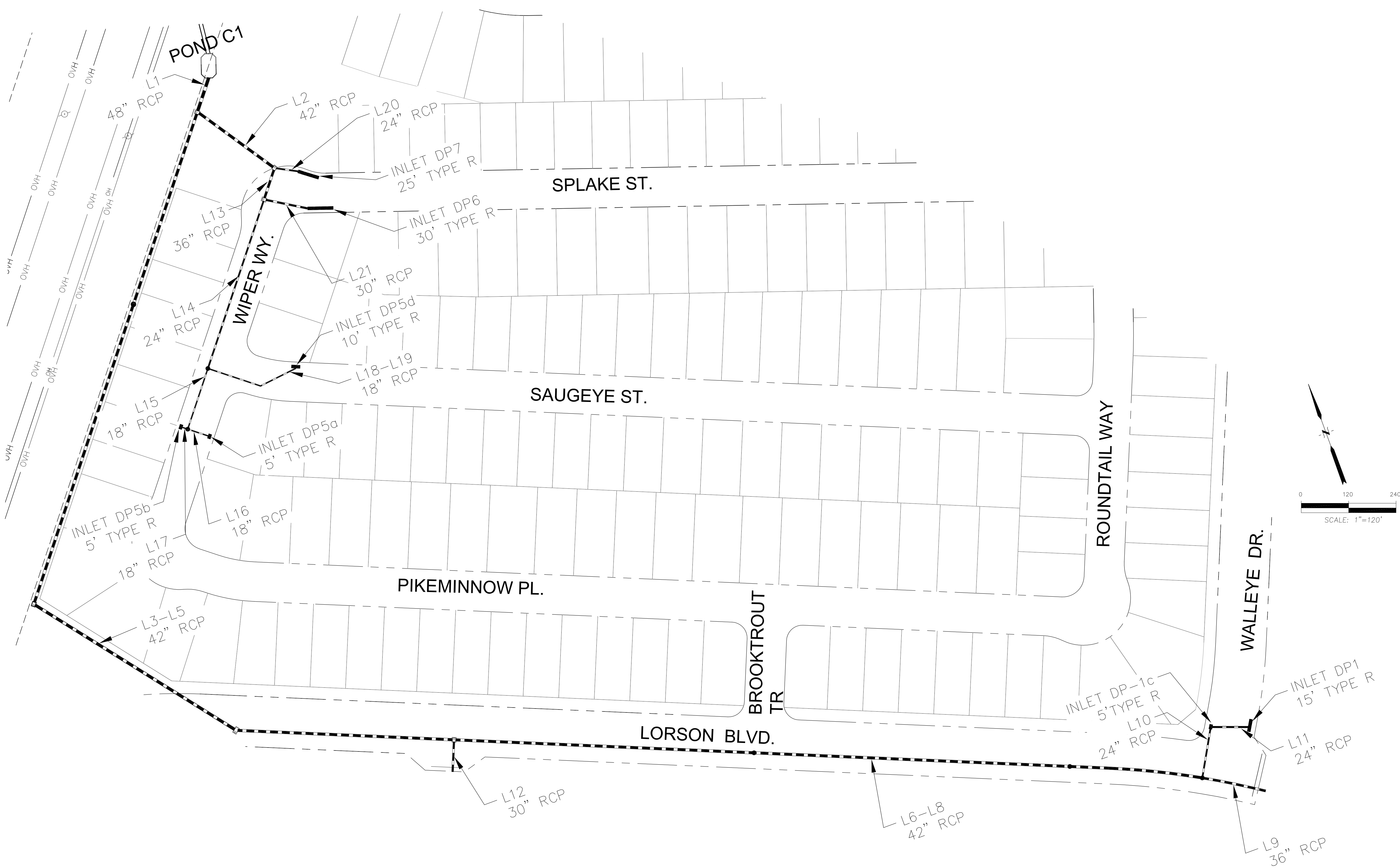
Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	96.84	1	21	122,021	----	------	------	Basin C4.2-ex
2	Rational	8.870	1	21	11,176	----	------	------	Basins C4.1-ex
3	Combine	105.71	1	21	133,197	1, 2	------	------	Pond C4 interim inflow
4	Reservoir	21.16	1	38	133,196	3	5768.59	96,844	Pond C4 Interim Outflo

pond c4 existing-100yr.gpw	Return Period: 100 Year	Monday, May 18 2020, 4:20 PM

APPENDIX E– STORM SEWER SCHEMATIC AND HYDRAFLOW STORM SEWER CALCS

BASINS C1 AND C2 STORM SCHEMATIC



CORE ENGINEERING GROUP
15004 1ST AVE. S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

NO.	DESCRIPTION	DATE

PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVE., SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD - WALLEYE DR
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASINS C1 AND C2
THE HILLS AT LORSON RANCH

DATE
MAY 25, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

TOTAL SHEETS: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	95.60	48 c	48.1	5747.75	5752.32	9.509	5752.81	5755.21	1.43	5755.21	End
2	2	38.10	42 c	120.3	5752.82	5760.52	6.402	5756.47	5762.41	n/a	5762.41 j	1
3	3	57.50	42 c	656.0	5753.00	5770.06	2.601	5756.16	5772.38	1.10	5772.38	1
4	4	57.50	42 c	303.8	5770.40	5775.41	1.649	5772.95	5777.73	0.64	5777.73	3
5	5	57.50	42 c	272.1	5775.60	5784.99	3.451	5778.30	5787.31	1.12	5787.31	4
6	6	43.20	42 c	385.0	5785.00	5788.08	0.800	5788.12	5790.09	n/a	5790.09 j	5
7	7	43.20	42 c	405.9	5788.20	5792.99	1.180	5790.66	5795.00	n/a	5795.00 j	6
8	8	43.20	42 c	161.5	5793.10	5794.39	0.799	5795.57	5796.40	n/a	5796.40 j	7
9	9	37.10	36 c	80.6	5795.50	5797.11	1.998	5796.86	5799.13	0.84	5799.97	8
10	10	6.10	24 c	67.1	5796.00	5796.67	0.998	5797.23	5797.55	n/a	5797.55 j	8
11	11	4.80	24 c	47.0	5797.20	5797.58	0.808	5797.86	5798.36	0.28	5798.64	10
12	12	14.30	30 c	43.8	5785.99	5786.08	0.205	5788.27	5788.31	0.15	5788.46	5
13	13	26.00	36 c	36.2	5761.02	5761.50	1.328	5763.00	5763.13	0.69	5763.13	2
14	14	11.70	24 c	230.8	5763.65	5767.81	1.802	5764.51	5769.02	n/a	5769.02	13
15	15	6.30	18 c	81.3	5768.30	5770.33	2.498	5769.36	5771.29	n/a	5771.29 j	14
16	16	2.40	18 c	26.5	5770.80	5771.01	0.793	5771.69	5771.66	0.16	5771.83	15
17	17	3.90	18 c	11.0	5770.80	5770.91	1.003	5771.65	5771.67	n/a	5771.96 j	15
18	18	5.40	18 c	73.0	5768.30	5769.03	1.000	5769.41	5769.92	n/a	5769.92 j	14
19	19	5.40	18 c	48.6	5769.03	5769.52	1.009	5770.16	5770.41	n/a	5770.41 j	18
20	20	12.10	24 c	35.5	5762.02	5762.38	1.014	5763.06	5763.68	0.49	5764.17	2
21	21	14.30	30 c	61.8	5762.00	5762.62	1.004	5763.68	5763.88	n/a	5763.88 j	13
22	22	10.70	24 c	122.0	5747.11	5765.29	14.902	5748.27	5766.45	n/a	5766.45 j	End
23	23	7.90	18 c	61.2	5766.80	5768.63	2.992	5767.49	5769.70	n/a	5769.70	22

The Hills-C1 basins 5-yr	Number of lines: 23	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; j - Line contains hyd. jump.

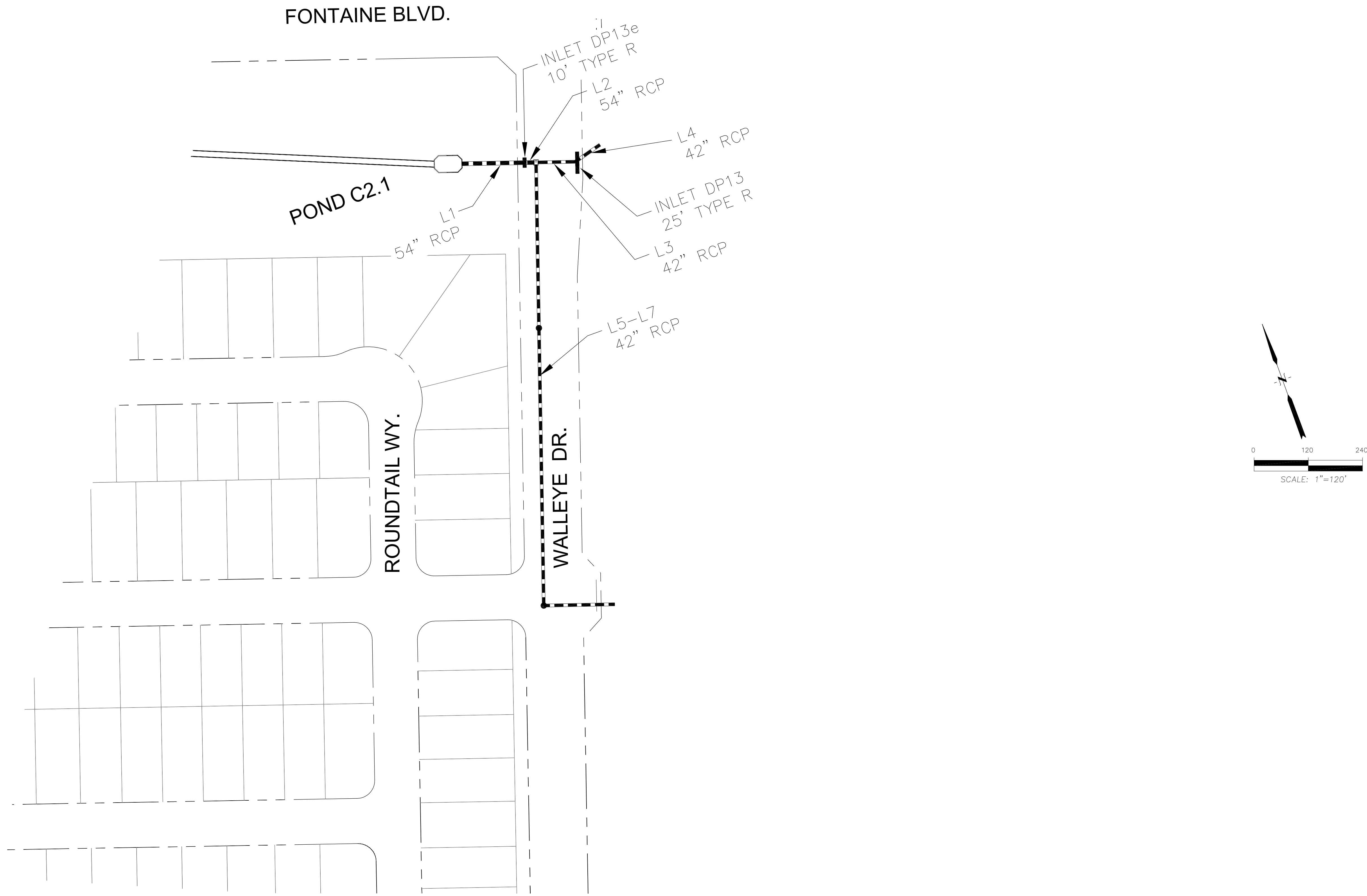
Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	208.5	48 c	48.1	5747.75	5752.32	9.509	5752.81	5756.19	n/a	5756.19	End
2	2	81.90	42 c	120.3	5752.82	5760.52	6.402	5759.43	5763.29	1.50	5763.29	1
3	3	126.6	42 c	656.0	5753.00	5770.06	2.601	5757.86	5773.36	n/a	5773.36	1
4	4	126.6	42 c	303.8	5770.40	5775.41	1.649	5773.49	5778.71	n/a	5778.71	3
5	5	126.6	42 c	272.1	5775.60	5784.99	3.451	5778.84	5788.29	n/a	5788.29	4
6	6	88.60	42 c	385.0	5785.00	5788.08	0.800	5789.79*	5792.78*	0.20	5792.98	5
7	7	88.60	42 c	405.9	5788.20	5792.99	1.180	5792.98	5795.87	n/a	5795.87	6
8	8	88.60	42 c	161.5	5793.10	5794.39	0.799	5796.25	5797.27	n/a	5797.27	7
9	9	65.30	36 c	80.6	5795.50	5797.11	1.998	5797.64	5799.71	n/a	5799.71	8
10	10	23.30	24 c	67.1	5796.00	5796.67	0.998	5798.12*	5798.83*	1.28	5800.11	8
11	11	20.30	24 c	47.0	5797.20	5797.58	0.808	5800.32*	5800.70*	0.65	5801.35	10
12	12	38.00	30 c	43.8	5785.99	5786.43	1.004	5790.18*	5790.55*	0.93	5791.49	5
13	13	52.00	36 c	42.0	5761.03	5761.51	1.143	5764.01	5764.08	1.01	5765.09	2
14	14	17.20	24 c	225.0	5763.76	5767.81	1.800	5765.64	5769.28	n/a	5769.28 j	13
15	15	8.80	18 c	81.3	5768.30	5770.33	2.498	5769.65	5771.46	n/a	5771.46 j	14
16	16	3.50	18 c	26.5	5770.80	5771.01	0.793	5771.87	5771.85	0.18	5772.03	15
17	17	5.30	18 c	11.0	5770.80	5770.91	1.003	5771.91	5771.87	0.31	5772.18	15
18	18	8.40	18 c	73.0	5768.30	5769.03	1.000	5769.68	5770.14	n/a	5770.14 j	14
19	19	8.40	18 c	48.6	5769.03	5769.52	1.009	5770.35	5770.63	n/a	5770.63 j	18
20	20	29.90	24 c	35.5	5762.01	5762.37	1.015	5764.01*	5764.63*	1.41	5766.04	2
21	21	34.80	30 c	60.0	5762.01	5762.61	1.000	5765.32*	5765.75*	0.78	5766.54	13
22	22	23.40	24 c	122.0	5747.11	5765.28	14.897	5748.83	5767.00	n/a	5767.00	End
23	23	17.20	18 c	58.6	5766.80	5768.56	3.003	5767.96*	5770.29*	1.47	5771.76	22

The Hills-C1 basins 100-yr	Number of lines: 23	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

BASINS C3 AND C4 STORM SCHEMATIC



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(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD - WALLEYE DR
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASINS C3 AND C4
THE HILLS AT LORSON RANCH

DATE
MAY 25, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

TOTAL SHEETS: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	104.1	54 c	69.0	5763.50	5773.78	14.901	5766.52	5776.71	0.70	5776.71	End
2	2	101.2	54 c	13.8	5774.55	5774.86	2.248	5777.48	5777.75	1.37	5777.75	1
3	3	31.50	42 c	43.6	5776.00	5776.44	1.009	5778.78	5778.72	0.31	5779.02	2
4	4	20.30	42 c	34.0	5776.94	5777.28	1.000	5779.13	5779.07	0.26	5779.33	3
5	5	69.70	42 c	184.4	5776.50	5779.82	1.801	5778.30	5782.38	0.20	5782.38	2
6	6	69.70	42 c	306.0	5779.92	5787.52	2.483	5782.89	5790.08	1.33	5790.08	5
7	7	69.70	42 c	78.4	5787.82	5788.60	0.995	5790.59	5791.16	1.33	5791.16	6

The Hills-C3-C4 basins 5yr	Number of lines: 7	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs.

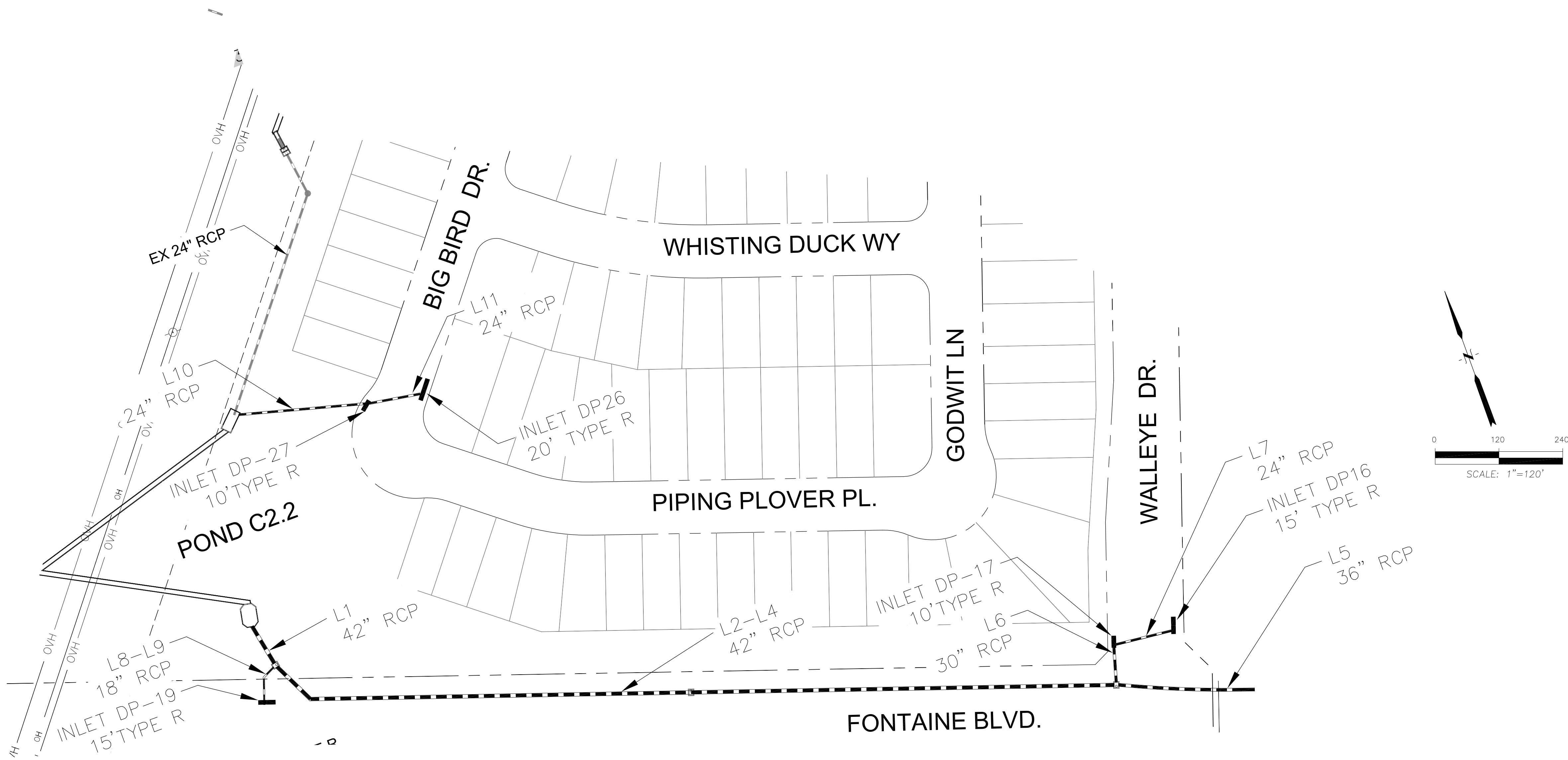
Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	223.8	54 c	69.0	5763.50	5773.78	14.901	5768.00	5777.96	1.64	5777.96	End
2	2	218.6	54 c	13.8	5774.25	5774.53	2.029	5778.30	5778.68	n/a	5778.68	1
3	3	81.60	42 c	43.6	5775.93	5776.44	1.169	5780.72*	5781.01*	0.97	5781.98	2
4	4	57.10	42 c	34.2	5776.94	5777.28	0.993	5782.55*	5782.66*	0.55	5783.21	3
5	5	137.0	42 c	184.4	5776.08	5779.82	2.029	5778.82*	5783.72*	0.47	5784.19	2
6	6	137.0	42 c	306.0	5779.92	5787.52	2.483	5784.19	5790.87	n/a	5790.87	5
7	7	137.0	42 c	78.4	5787.82	5788.60	0.995	5791.32*	5792.78*	3.15	5795.93	6

The Hills-C3-C4 basins 100yr | Number of lines: 7 | Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown).

BASINS C5 AND C7 STORM SCHEMATIC



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PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD. - WALLEYE DR
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASINS C5 & C7
THE HILLS AT LORSON RANCH

DATE
MAY 25, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

TOTAL SHEETS: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	58.30	42 c	47.9	5747.40	5753.79	13.343	5750.90	5756.13	n/a	5756.13	End
2	2	53.60	42 c	44.9	5754.00	5755.49	3.322	5756.78	5757.73	n/a	5757.73 j	1
3	3	53.60	42 c	357.9	5755.49	5767.41	3.330	5758.30	5769.65	n/a	5769.65 j	2
4	4	53.60	42 c	399.3	5767.70	5777.48	2.449	5770.22	5779.72	n/a	5779.72 j	3
5	5	42.30	36 c	130.1	5778.00	5780.47	1.899	5780.22	5782.54	n/a	5782.54 j	4
6	6	11.30	30 c	38.5	5778.70	5779.11	1.063	5780.53	5780.45	0.41	5780.86	4
7	7	7.90	24 c	55.3	5779.75	5780.29	0.977	5781.04	5781.29	n/a	5781.29 j	6
8	8	4.70	18 c	17.6	5755.81	5755.99	1.023	5757.07	5757.05	0.14	5757.19	1
9	9	4.70	18 c	24.5	5755.99	5756.24	1.019	5757.27	5757.26	0.21	5757.47	8
10	10	16.40	24 c	124.0	5748.00	5765.36	14.000	5749.43	5766.79	n/a	5766.79	End
11	11	10.80	24 c	47.9	5767.10	5767.58	1.002	5768.07	5768.75	0.50	5769.25	10

The Hills-C5 basins 5-yr	Number of lines: 11	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; j - Line contains hyd. jump.

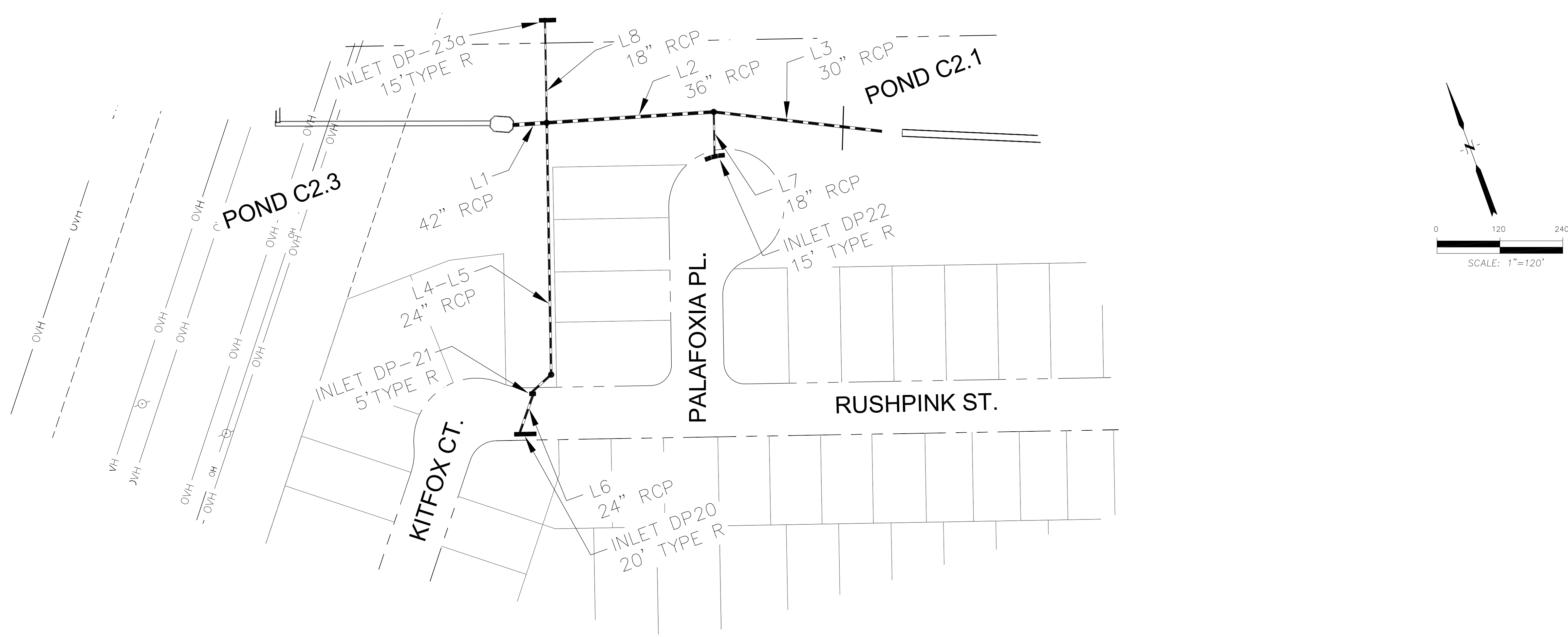
Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	126.0	42 c	47.9	5747.40	5753.79	13.343	5750.90	5757.08	2.74	5757.08	End
2	2	116.3	42 c	44.9	5754.00	5755.49	3.322	5757.61	5758.72	1.81	5758.72	1
3	3	116.3	42 c	357.9	5755.49	5767.41	3.330	5758.89	5770.64	0.37	5770.64	2
4	4	116.3	42 c	399.3	5767.70	5777.48	2.449	5770.81	5780.71	2.45	5780.71	3
5	5	92.50	36 c	130.1	5778.00	5780.47	1.899	5780.71	5783.33	n/a	5783.33	4
6	6	23.80	30 c	38.5	5778.70	5779.11	1.063	5782.79*	5782.92*	0.54	5783.46	4
7	7	17.70	24 c	55.3	5779.75	5780.29	0.977	5783.46*	5783.80*	0.49	5784.29	6
8	8	9.70	18 c	17.6	5755.81	5755.99	1.023	5759.41*	5759.56*	0.34	5759.91	1
9	9	9.70	18 c	24.5	5755.99	5756.24	1.019	5759.91*	5760.12*	0.47	5760.58	8
10	10	36.50	24 c	124.0	5748.00	5765.36	14.000	5749.93	5767.29	1.07	5767.29	End
11	11	24.00	24 c	47.2	5767.10	5767.57	0.995	5768.89	5769.36	1.02	5770.38	10

The Hills-C5 basins 100-yr	Number of lines: 11	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown).

BASIN C6 STORM SCHEMATIC



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PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD. - WALLEYE DR
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASIN C6
THE HILLS AT LORSON RANCH

DATE
MAY 25, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

TOTAL SHEETS: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	36.90	42 c	32.3	5746.50	5751.31	14.899	5752.81	5753.17	0.78	5753.17	End
2	2	20.30	36 c	158.3	5751.90	5757.92	3.803	5753.83	5759.36	n/a	5759.36 j	1
3	3	12.80	30 c	156.9	5758.50	5759.91	0.899	5759.82	5761.11	n/a	5761.11 j	2
4	4	10.20	24 c	237.6	5753.50	5766.57	5.500	5754.10	5767.70	0.35	5767.70	1
5	5	10.20	24 c	28.4	5766.90	5767.18	0.988	5768.02	5768.31	0.32	5768.31	4
6	6	9.10	24 c	35.5	5767.30	5767.65	0.987	5768.66	5768.72	n/a	5768.72 j	5
7	7	7.50	18 c	42.2	5760.00	5764.01	9.506	5760.49*	5765.78*	0.28	5766.06	2
8	8	6.40	18 c	101.8	5753.31	5754.37	1.042	5754.15	5755.34	0.44	5755.34	1

The Hills- C6basins 5-yr	Number of lines: 8	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

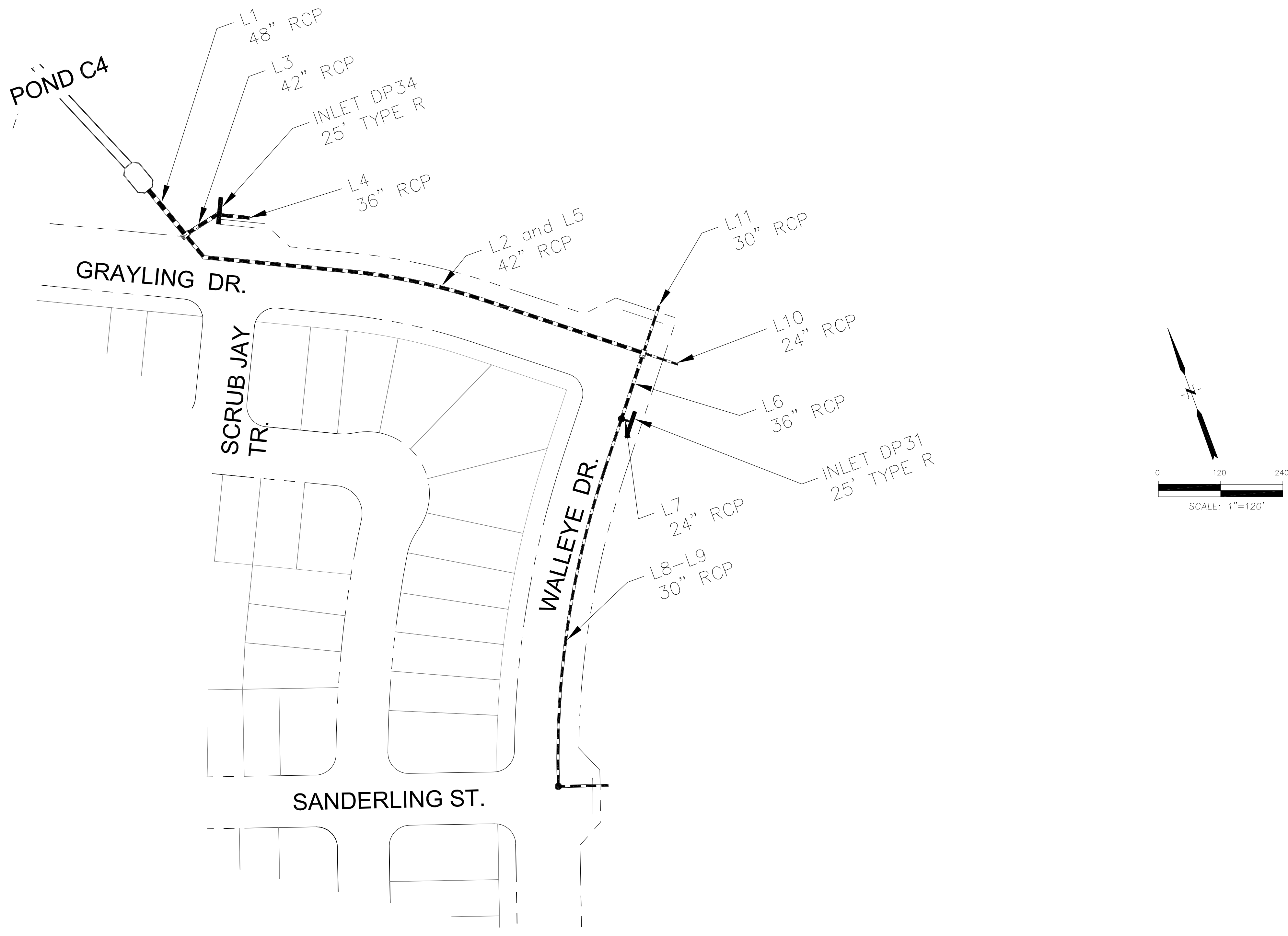
Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		114.1	42 c	32.3	5746.50	5751.31	14.899	5752.81	5754.52	2.37	5754.52	End
2		81.20	36 c	158.3	5751.90	5757.92	3.803	5754.84	5760.71	n/a	5760.71	1
3		65.00	30 c	156.9	5758.50	5759.91	0.899	5761.00*	5764.94*	2.73	5767.67	2
4		22.50	24 c	237.6	5753.50	5766.57	5.500	5756.09	5768.25	n/a	5768.25 j	1
5		22.50	24 c	28.4	5766.90	5767.18	0.988	5768.54	5768.86	0.65	5769.52	4
6		20.10	24 c	35.5	5767.30	5767.65	0.987	5769.87*	5770.15*	0.64	5770.78	5
7		16.20	18 c	42.2	5760.00	5764.01	9.506	5761.59	5765.44	n/a	5765.44 j	2
8		10.40	18 c	101.8	5754.00	5755.02	1.002	5756.35*	5757.35*	0.54	5757.89	1

The Hills- C6basins 100-yr	Number of lines: 8	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

BASINS C8 STORM SCHEMATIC



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PROJECT:
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FONTAINE BLVD. - WALLEYE DR
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASIN C8
THE HILLS AT LORSON RANCH

DATE
MAY 25, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

TOTAL SHEETS: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	83.30	48 c	52.0	5767.90	5773.12	10.043	5770.89	5775.82	0.00	5775.82	End
2	2	45.10	42 c	28.0	5778.11	5778.83	2.572	5779.38*	5782.63*	0.00	5782.63	1
3	3	38.20	42 c	36.0	5777.61	5777.97	1.001	5779.11	5780.32	0.00	5780.32	1
4	4	7.30	36 c	31.0	5778.47	5778.84	1.192	5780.76	5780.75	0.00	5780.75	3
5	5	45.10	42 c	436.0	5778.83	5790.00	2.562	5782.63	5792.06	n/a	5792.06 j	2
6	6	23.40	36 c	67.0	5790.50	5791.51	1.507	5792.80	5793.05	n/a	5793.05 j	5
7	7	14.50	30 c	10.0	5792.51	5792.71	2.002	5793.55	5793.99	0.00	5793.99	6
8	8	8.90	30 c	362.0	5792.01	5794.41	0.663	5793.64	5795.41	n/a	5795.41 j	6
9	9	8.90	30 c	48.0	5794.71	5795.19	1.000	5795.73	5796.19	n/a	5796.19 j	8
10	10	13.20	24 c	35.0	5791.50	5792.35	2.427	5792.70	5793.64	n/a	5793.64	5
11	11	19.30	30 c	48.0	5791.00	5791.67	1.396	5792.73	5793.14	n/a	5793.14	5

Project File: 100.061Basin C8, 5yr flow.stm | Number of lines: 11 | Run Date: 05-28-2020

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

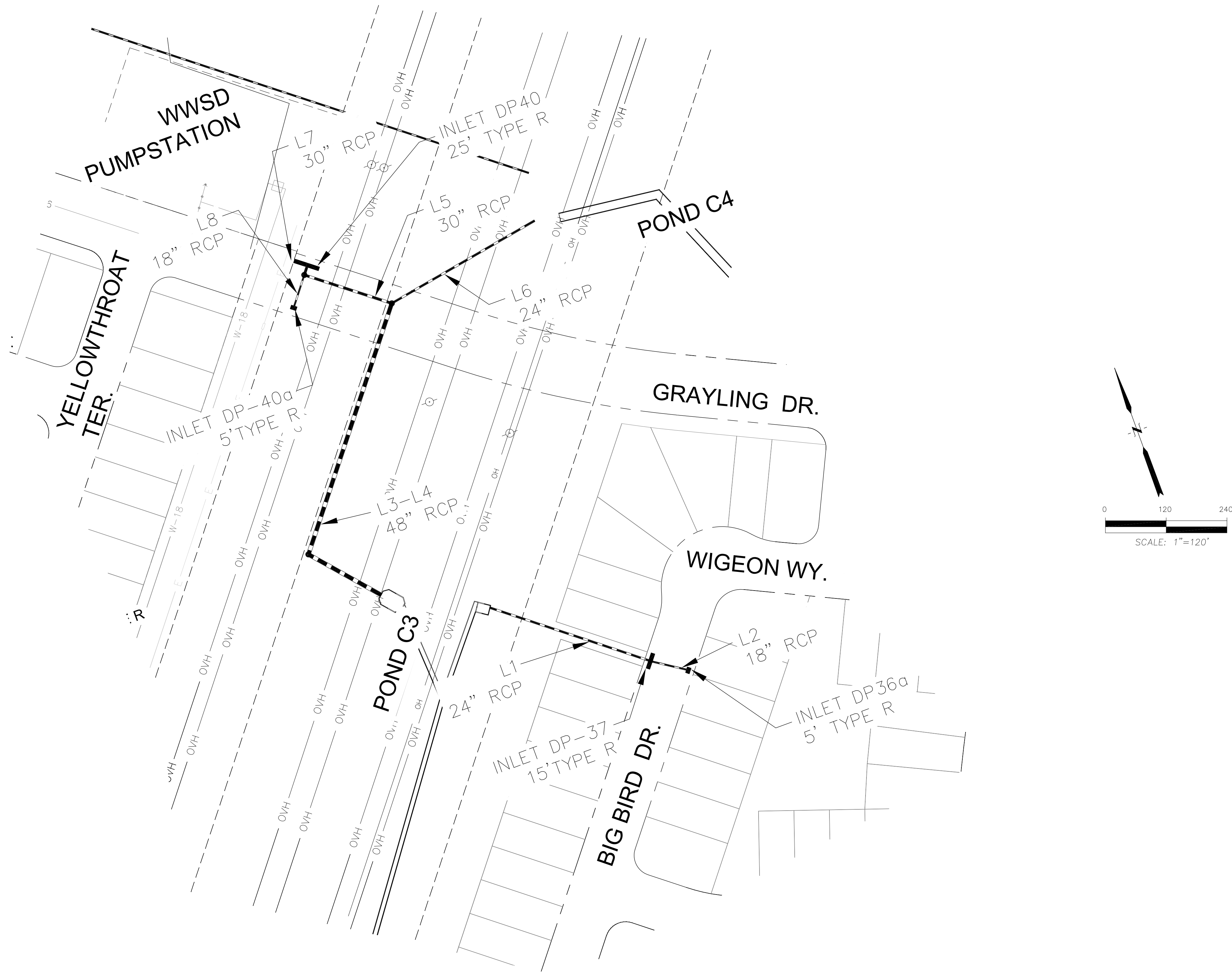
Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	189.9	48 c	52.0	5767.90	5773.12	10.039	5771.78	5776.94	0.00	5776.94	End
2	2	105.4	42 c	28.0	5778.11	5778.83	2.572	5780.17*	5783.78*	0.00	5783.78	1
3	3	84.50	42 c	36.0	5777.61	5777.97	1.001	5780.07	5781.20	0.00	5781.20	1
4	4	15.30	36 c	31.0	5778.47	5778.84	1.192	5782.42*	5782.43*	0.00	5782.43	3
5	5	105.4	42 c	436.0	5778.83	5790.00	2.562	5783.78	5793.13	0.00	5793.13	2
6	6	50.90	36 c	67.0	5790.50	5791.51	1.507	5794.39*	5794.78*	0.00	5794.78	5
7	7	30.00	24 c	10.0	5792.51	5792.71	2.002	5794.78*	5794.96*	0.00	5794.96	6
8	8	20.90	30 c	362.0	5792.01	5794.41	0.663	5795.30	5796.21	0.00	5796.21	6
9	9	20.90	30 c	48.0	5794.71	5795.19	1.000	5796.40	5796.72	n/a	5796.72	8
10	10	29.40	24 c	35.0	5791.50	5792.35	2.429	5793.86*	5794.46*	0.00	5794.46	5
11	11	49.40	30 c	48.0	5790.50	5791.17	1.396	5793.65*	5794.35*	0.00	5794.35	5

Project File: 100.061Basin C8, 100yr flow.stm | Number of lines: 11 | Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown).

BASIN C10 STORM SCHEMATIC



CORE
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NO.	DESCRIPTION	DATE

PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVE., SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD – WALLEYE DR
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASIN C10
THE HILLS AT LORSON RANCH

DATE
MAY 25, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

TOTAL SHEETS: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	12.40	24 c	171.4	5759.50	5775.53	9.352	5761.50	5776.78	n/a	5776.78 j	End
2	2	5.20	18 c	29.9	5776.30	5776.60	1.005	5777.21	5777.47	n/a	5777.47 j	1
3	3	33.00	48 c	82.6	5759.68	5760.10	0.509	5762.69	5762.69	0.23	5762.92	End
4	4	33.00	48 c	261.9	5760.20	5761.51	0.500	5763.04	5763.21	n/a	5763.21 j	3
5	5	16.50	30 c	91.4	5763.00	5764.90	2.078	5763.90	5766.26	n/a	5766.26	4
6	6	16.50	24 c	163.0	5763.50	5764.97	0.902	5764.81	5766.41	n/a	5766.41	4
7	7	14.70	30 c	10.1	5765.00	5765.40	3.948	5766.69	5766.68	n/a	5766.68	5
8	8	1.80	18 c	32.4	5766.40	5766.66	0.803	5766.85	5767.18	0.17	5767.35	5

The Hills-C10 basins 5-yr	Number of lines: 8	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; j - Line contains hyd. jump.

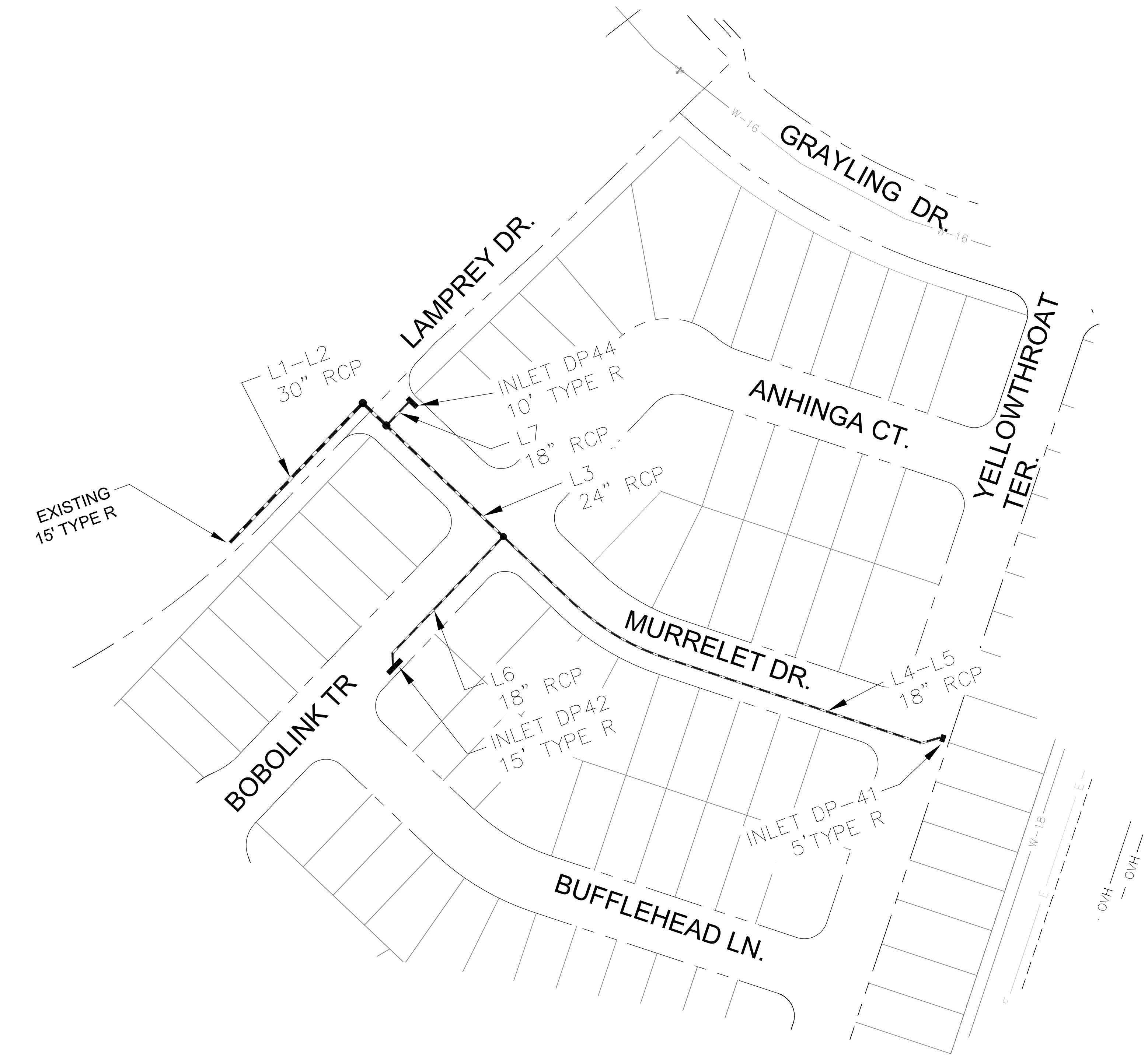
Storm Sewer Summary Report

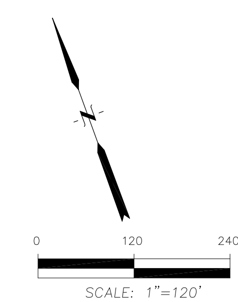
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	27.50	24 c	171.4	5759.50	5775.53	9.352	5761.50	5777.35	n/a	5777.35 j	End
2	2	9.30	18 c	29.9	5776.30	5776.60	1.005	5778.23*	5778.46*	0.43	5778.89	1
3	3	86.20	48 c	82.6	5759.68	5760.10	0.509	5762.69	5762.86	1.34	5764.20	End
4	4	86.20	48 c	261.9	5760.20	5761.51	0.500	5764.82*	5765.77*	0.73	5766.50	3
5	5	42.50	30 c	91.4	5763.00	5764.90	2.078	5766.50*	5767.48*	1.17	5768.65	4
6	6	43.70	24 c	163.0	5763.50	5764.97	0.902	5766.50*	5772.58*	3.01	5775.59	4
7	7	35.60	30 c	10.1	5765.00	5765.40	3.948	5768.99*	5769.07*	0.82	5769.89	5
8	8	6.90	18 c	32.4	5766.40	5766.66	0.803	5769.57*	5769.71*	0.24	5769.95	5

The Hills-C10 basins 100-yr	Number of lines: 8	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

BASIN C12 STORM SCHEMATIC





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NO.	DESCRIPTION	DATE

PREPARED FOR:
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(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD. - WALLEYE DR
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASIN C12
THE HILLS AT LORSON RANCH

DATE
MAY 25, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

TOTAL SHEETS: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	17.00	30 c	164.2	5747.30	5750.58	1.998	5752.81	5753.08	0.19	5753.26	End
2	2	17.00	30 c	25.9	5752.00	5752.52	2.004	5753.26	5753.90	n/a	5753.90	1
3	3	8.80	24 c	136.2	5753.50	5754.86	0.998	5754.37	5755.91	0.43	5755.91	2
4	4	2.40	18 c	81.2	5755.36	5756.17	0.998	5756.31	5756.76	n/a	5756.76 j	3
5	5	2.40	18 c	334.4	5756.27	5762.96	2.000	5756.95	5763.55	n/a	5763.55 j	4
6	6	6.40	18 c	142.2	5755.36	5756.78	0.999	5756.21	5757.75	0.44	5757.75	3
7	7	8.20	18 c	26.2	5754.00	5754.26	0.992	5755.00	5755.36	0.55	5755.90	2

The Hills-C12 basins 5-yr	Number of lines: 7	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; j - Line contains hyd. jump.

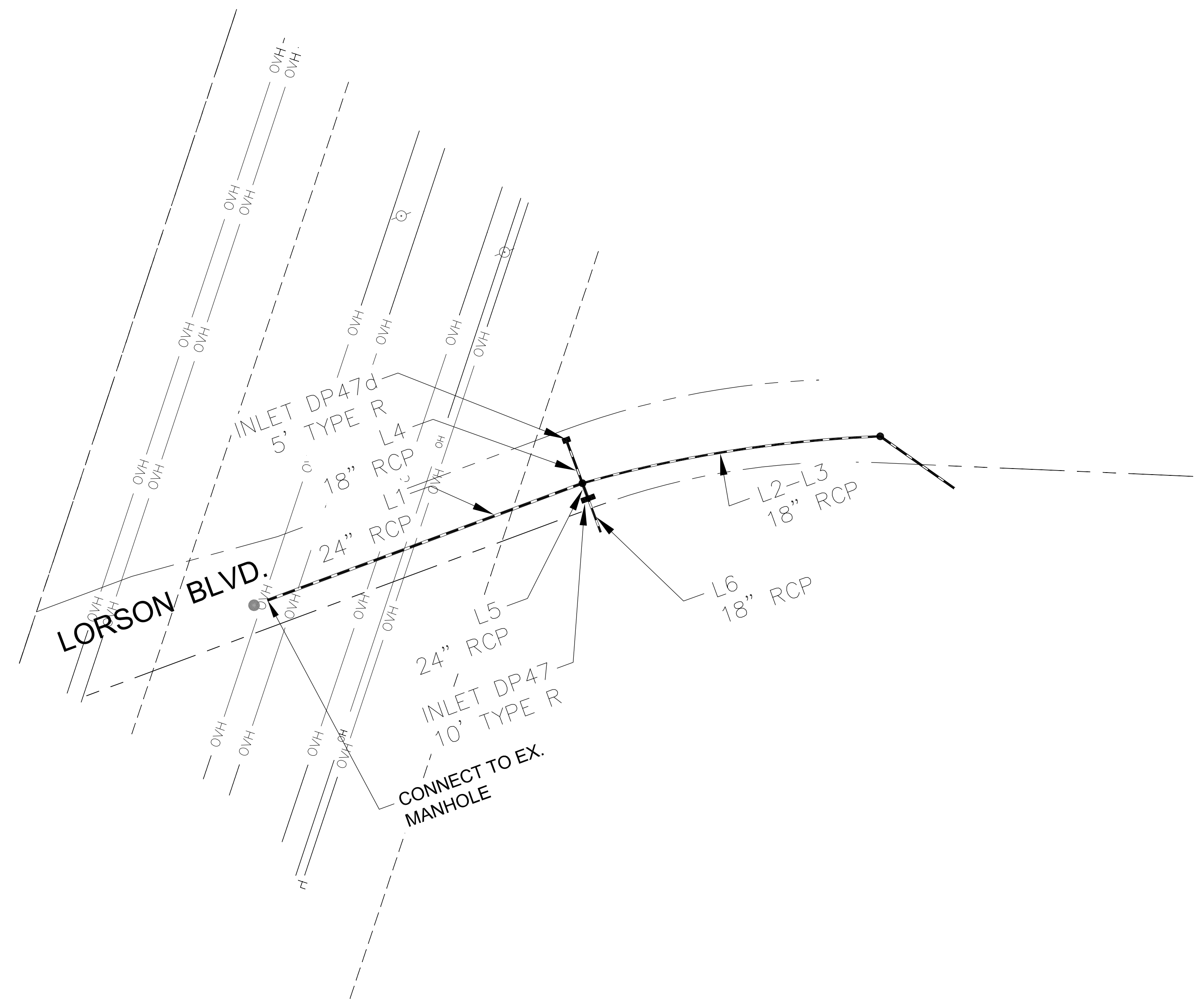
Storm Sewer Summary Report

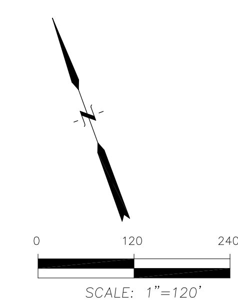
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	25.20	30 c	164.2	5747.30	5750.58	1.998	5752.81*	5753.43*	0.41	5753.84	End
2	2	25.20	30 c	25.9	5752.00	5752.52	2.004	5753.84	5754.20	n/a	5754.20	1
3	3	16.90	24 c	136.2	5753.50	5754.86	0.998	5754.79	5756.32	0.74	5756.32	2
4	4	5.40	18 c	81.2	5755.36	5756.17	0.998	5756.91	5757.06	n/a	5757.24 j	3
5	5	5.40	18 c	334.4	5756.27	5762.96	2.000	5757.47	5763.85	n/a	5763.85 j	4
6	6	11.50	18 c	142.2	5755.36	5756.78	0.999	5756.86*	5758.57*	0.66	5759.22	3
7	7	8.30	18 c	26.2	5754.00	5754.26	0.992	5755.01	5755.36	0.55	5755.92	2

The Hills-C12 basins 100-yr	Number of lines: 7	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

BASIN D1 STORM SCHEMATIC





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PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD. - WALLEYE DR
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASIN D1
THE HILLS AT LORSON RANCH

DATE
MAY 25, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

TOTAL SHEETS: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	line d1	16.18	24 c	270.0	5750.92	5761.45	3.900	5752.35	5762.88	n/a	5762.88 j	End
2	line d2	4.60	18 c	232.8	5763.05	5774.23	4.802	5763.51	5775.05	0.25	5775.05	1
3	line d3	4.60	18 c	77.2	5774.37	5775.14	0.998	5775.28	5775.96	n/a	5775.96 j	2
4	line d4	2.48	18 c	36.6	5763.05	5763.34	0.792	5763.58	5763.95	0.21	5764.16	1
5	line d5	9.10	24 c	14.2	5761.55	5761.69	0.989	5763.42	5763.43	0.08	5763.50	1
6	line d6	5.90	18 c	18.3	5762.30	5762.48	0.984	5763.50	5763.44	0.38	5763.82	5

The Hills-D basins 5-yr	Number of lines: 6	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	line d1	32.11	24 c	270.0	5750.92	5761.45	3.900	5752.81	5763.34	n/a	5763.34	End
2	line d2	10.10	18 c	232.8	5763.05	5774.23	4.802	5764.53	5775.44	n/a	5775.44 j	1
3	line d3	10.10	18 c	77.2	5774.37	5775.14	0.998	5775.61	5776.35	n/a	5776.35 j	2
4	line d4	3.57	18 c	36.6	5763.05	5763.34	0.792	5764.97*	5765.02*	0.06	5765.08	1
5	line d5	18.44	24 c	14.2	5761.55	5761.69	0.989	5764.50*	5764.60*	0.27	5764.86	1
6	line d6	13.00	18 c	18.3	5762.30	5762.48	0.984	5764.86*	5765.14*	0.84	5765.99	5

The Hills-D basins 100-yr	Number of lines: 6	Run Date: 05-19-2020

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

APPENDIX F – 2019 Annual Report of Drainage/Bridge Fee Credits

Lorson Ranch Drainage/Surety Fees and Drainage Fee Report

	Subdivision Name	Drainage Fee	Surety	pay out	Credits	Credit balance
06-491	credit established				$ 6,804,637.69	$ 6,804,637.69
06-491	payout			$ (403,041.97)		$ 6,401,595.72
07-485	payout			$ (223,130.33)		$ 6,178,465.39
07-485	Ponderosa Filing No. 1	$ (151,208.00)				$ 6,027,257.39
10-255	payout			$ (238,680.00)		$ 5,788,577.39
12-117	payout			$ (65,250.00)		$ 5,723,327.39
12-117	Ponderosa Filing No. 2	$ (192,765.00)				$ 5,530,562.39
12-117	Pioneer Landing	$ (219,500.00)				$ 5,311,062.39
12-117	Townhomes at Lorson	$ (68,512.50)				$ 5,242,549.89
13-055	payout			$ (187,200.00)		$ 5,055,349.89
13-478	payout			$ (146,790.00)		$ 4,908,559.89
15-015	Ponderosa Filing No. 2		$ (89,957.00)			$ 4,818,602.89
15-015	Pioneer Landing		$ (102,433.00)			$ 4,716,169.89
15-015	Townhomes at Lorson		$ (31,972.50)			$ 4,684,197.39
15-015	Buffalo Crossing No. 2	$ (182,228.00)	$ (85,040.00)			$ 4,416,929.39
15-239	payout			$ (145,620.00)		$ 4,271,309.39
15-473	payout	$ (149,292.00)				$ 4,122,017.39
16-091	credit established				$ 745,604.28	$ 4,867,621.67
	Meadows Filing No. 1	$ (181,578.00)	$ (84,736.00)			$ 4,601,307.67
	Meadows Filing No. 2	$ (224,587.00)	$ (104,808.00)			$ 4,271,912.67
	Allegiant at Lorson	$ (162,021.00)	$ (75,610.00)			$ 4,034,281.67
	Buffalo Crossing No. 1	$ (78,975.00)	$ (36,855.00)			$ 3,918,451.67
						$ 3,918,451.67
	Meadows 3	$ (287,820.00)	$ (134,316.00)			$ 3,496,315.67
	Meadows 4	$ (464,200.00)	$ (216,626.00)			$ 2,815,489.67
	Pioneer Landing 2	$ (370,756.00)	$ (165,095.00)			$ 2,279,638.67
	Carriage Meadows South	$ (844,538.00)	$ (376,066.00)			$ 1,059,034.67
	Carriage Meadows North	$ (296,184.00)	$ (132,618.00)			$ 630,232.67
	Pioneer Landing 3	$ (15,832.00)	$ (7,089.00)			$ 607,311.67
	Lorson Ranch East Filing No. 1	$ (899,058.00)	$ (380,859.00)			$ (672,605.33)
20-17	credit established				$ 984,434.42	$ 311,829.09

Drainage Fee Pre-Credit Analysis

	Subdivision Name	Drainage Fee	Surety	pay out	Credits	Credit balance
	CDR 19-002 (Appr. with FAE, 7/21/20)				$ 2,074,670.20	$ 2,074,670.20
	Lorson Ranch East Filing No. 2	$ (322,236.00)	$ (136,506.00)			$ 1,615,928.20
	Lorson Ranch East Filing No. 3	$ (177,213.00)	$ (70,354.00)			$ 1,368,361.20
	Creekside at Lorson filing 1	$ (429,894.00)	$ (170,669.00)			$ 767,798.20
	totals	$ (5,718,397.50)	$ (2,401,609.50)	$ (1,409,712.30)	$ 10,609,346.59	

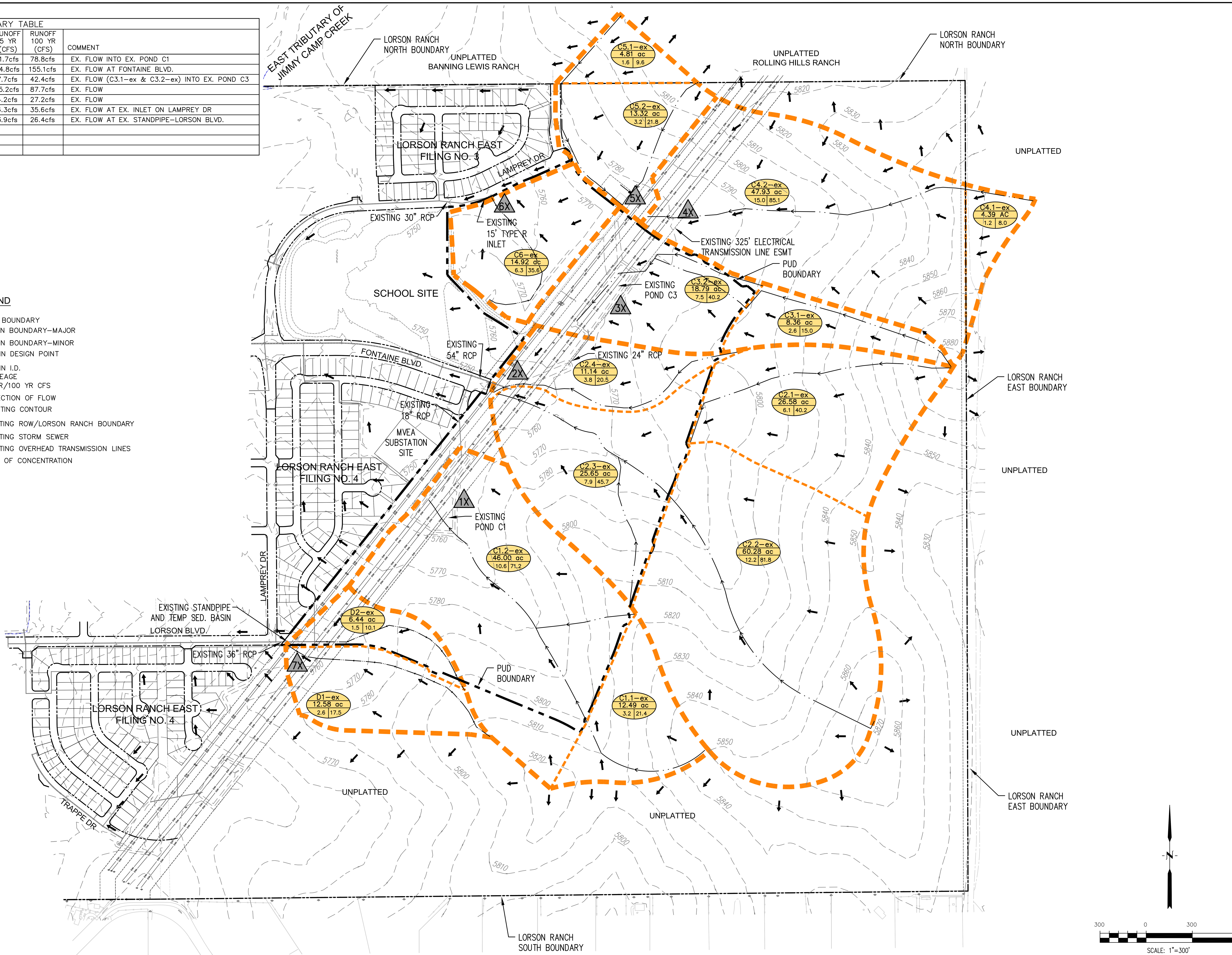
(green)	confirmed with resolution
(red)	current credit balance

	2019 Lorson Ranch Bridge Fee Report				
	Subdivision Name			**Bridge Fee**	**Total**
1	Partial Reimbursement			$ 26,579.14	$ 26,579.14
2	Partial Reimbursement				
3	Partial Reimbursement				
4	Partial Reimbursement				
5	Partial Reimbursement				
6	Partial Reimbursement				
7	Partial Reimbursement				
8	Partial Reimbursement				
9	Ponderosa Filing No. 1			$ 5,481.00	$ 5,481.00
10	Ponderosa Filing No. 2			$ 7,556.00	$ 7,556.00
11	Pioneer Landing			$ 9,278.00	$ 9,278.00
12	Meadows Filing No. 1			$ 8,134.00	$ 8,134.00
13	Meadows Filing No. 2			$ 9,493.00	$ 9,493.00
14	Townhomes at Lorson			$ 2,896.00	$ 2,896.00
15	Allegiant at Lorson			$ 6,848.00	$ 6,848.00
16	Buffalo Crossing No. 1			$ 3,538.00	$ 3,538.00
17	Buffalo Crossing No. 2			$ 8,164.00	$ 8,164.00
18	Meadows 3			$ 12,894.00	$ 12,894.00
19	Meadows 4			$ 20,796.00	$ 20,796.00
20	Pioneer Landing 2			$ 17,335.00	$ 17,335.00
21	Carriage Meadows South			$ 39,486.00	$ 39,486.00
22	Carriage Meadows North			$ 13,853.00	$ 13,853.00
23	Pioneer Landing 3			$ 741.00	$ 741.00
24	Lorson Ranch East Filing No. 1			$ 42,033.00	$ 42,033.00
25	Lorson Ranch East Filing No. 2			$ 15,064.00	$ 15,064.00
26	Lorson Ranch East Filing No. 3			$ 8,286.00	$ 8,286.00
27	Creekside at Lorson Ranch Filing No. 1			$ 20,100.00	$ 20,100.00
	Totals			$ 278,555.14	$ 278,555.14

Total Bridge Fee Credits	$ 3,663,376.23	(2,330,713.90+1,332,662.33)
Total Bridge Fees	$ 278,555.14	
Remaining	$ 3,384,821.09	

MAP POCKET

DESIGN POINT SUMMARY TABLE					
DESIGN POINT	BASIN	DRAINAGE AREA (AC)	RUNOFF 5 YR (CFS)	RUNOFF 100 YR (CFS)	COMMENT
1X	C1–ex	58.49	11.7cfs	78.8cfs	EX. FLOW INTO EX. POND C1
2X	C2–ex	123.65	24.8cfs	155.1cfs	EX. FLOW AT FONTAINE BLVD.
3X	C3–ex	27.15	7.7cfs	42.4cfs	EX. FLOW (C3.1–ex & C3.2–ex) INTO EX. POND C3
4X	C4–ex	52.32	15.2cfs	87.7cfs	EX. FLOW
5X	C5–ex	18.13	4.2cfs	27.2cfs	EX. FLOW
6X	C6–ex	14.92	6.3cfs	35.6cfs	EX. FLOW AT EX. INLET ON LAMPREY DR
7X	D2–ex	19.02	3.9cfs	26.4cfs	EX. FLOW AT EX. STANDPIPE–LORSON BLVD.



LEGEND

- PUD BOUNDARY
- BASIN BOUNDARY–MAJOR
- BASIN BOUNDARY–MINOR
- X — BASIN DESIGN POINT
- BASIN XXAC X.X X.X — BASIN I.D. ACREAGE 5 YR/100 YR CFS
- DIRECTION OF FLOW
- 6690 — EXISTING CONTOUR
- EXISTING ROW/LORSON RANCH BOUNDARY
- EXISTING STORM SEWER
- OVH — EXISTING OVERHEAD TRANSMISSION LINES
- TIME OF CONCENTRATION

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NO.	DESCRIPTION	DATE

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LORSON LLC
212 NORTH WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903 (719) 635–3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
EAST OF POWERLINES
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED:
CHECKED: RLS

EXISTING CONDITIONS
PUD / PRELIMINARY PLAN
THE HILLS AT LORSON RANCH

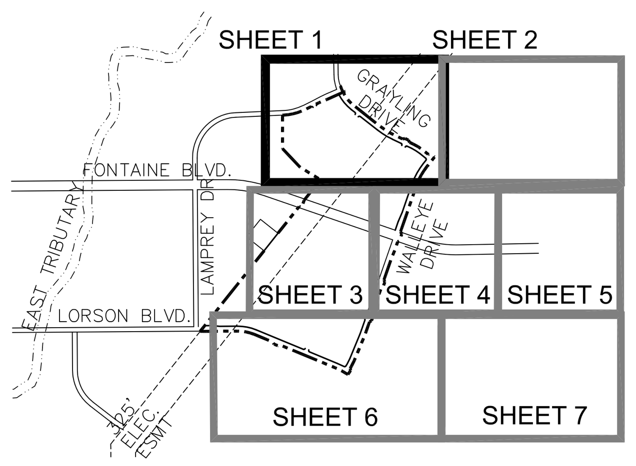
DATE: OCT 22, 2020
PROJECT NO. 100.061
SHEET NUMBER 1
TOTAL SHEETS: 1

LEGEND

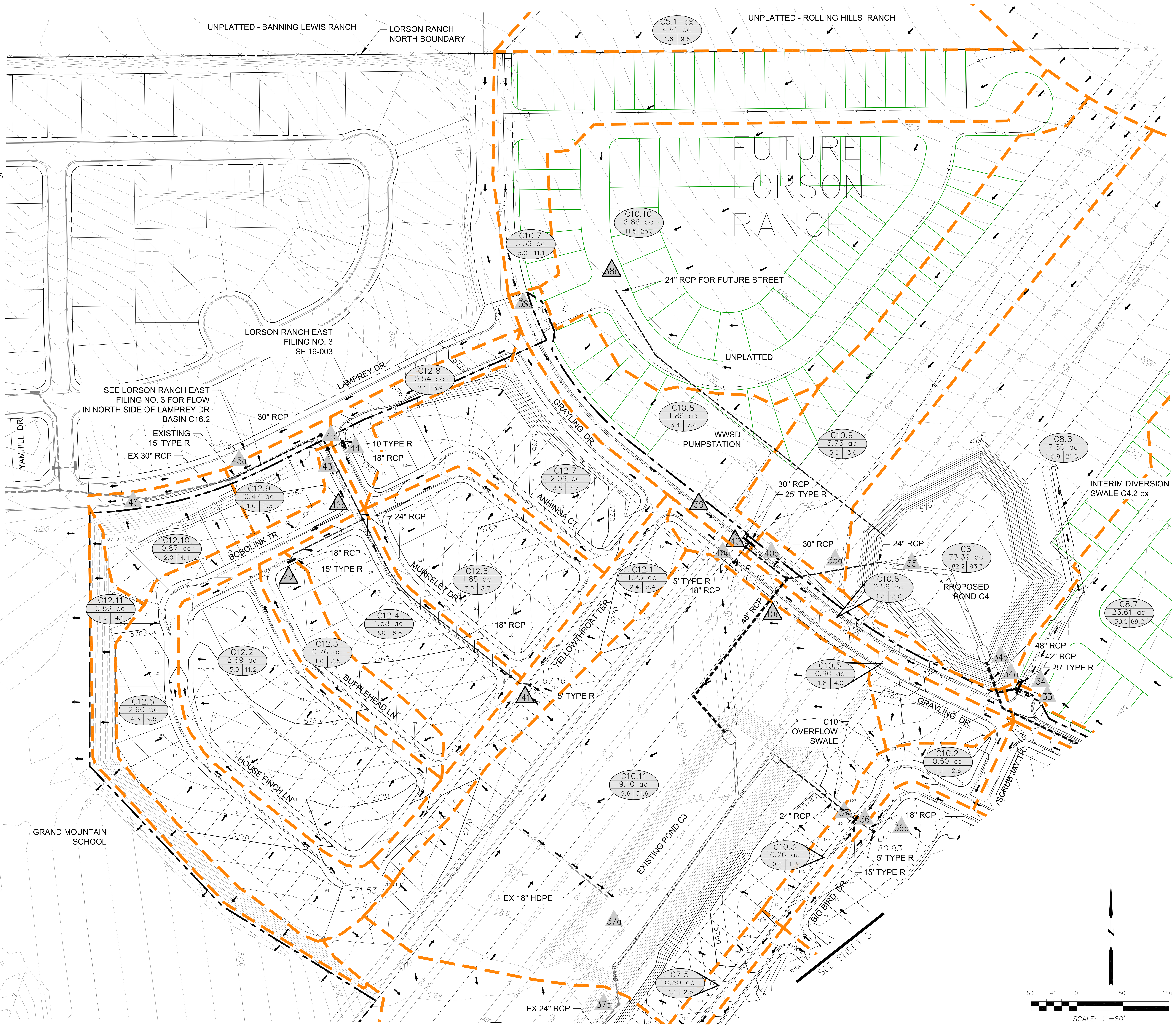
- PUD BOUNDARY
- BASIN BOUNDARY
- BASIN DESIGN POINT
- DENOTES OVERALL BASIN — BASIN I.D. (BASIN), ACREAGE (XX AC), 5 YR/100 YR CFS (X.X | X.X)
- DIRECTION OF FLOW
- EXISTING CONTOUR (6690)
- PROPOSED CONTOUR (6670)
- ROW/LORSON RANCH BOUNDARY
- EXISTING STORM SEWER
- EXISTING OVERHEAD TRANSMISSION LINES (OVH)
- PROPOSED STORM SEWER
- TIME OF CONCENTRATION
- HP — HIGH POINT
- LP — LOW POINT

RUNOFF SUMMARY

D.P.		5 YEAR cfs	100 YEAR cfs	NOTES
33		7.3	15.3	FLOW IN STORM SEWER
34		30.9	69.2	STREET FLOW
34a		38.2	84.5	FLOW IN STORM SEWER
34b		83.3	189.9	FLOW IN STORM SEWER
35		131.6	277.0	POND C4 INFLOW
35a		16.5	43.7	POND C4 OUTFLOW
36a		5.2	11.6	STREET FLOW
36		7.2	18.2	STREET FLOW
37		12.4	27.5	FLOW IN STORM SEWER
37a		41.2	111.6	POND C3 INFLOW
37b		4.9	32.1	POND C3 OUTFLOW
38a		11.5	25.3	FLOW IN STORM SEWER
38		6.8	21.9	STREET FLOW
39		8.8	25.7	STREET FLOW
40a		1.8	6.9	STREET FLOW
40		14.7	38.5	STREET FLOW
40b		16.5	42.5	FLOW IN STORM SEWER
40c		33.0	86.2	FLOW IN STORM SEWER
41		2.4	5.4	STREET FLOW
42		6.4	14.1	STREET FLOW
42a		8.8	16.9	FLOW IN STORM SEWER
43		7.3	18.9	STREET FLOW
44		8.2	9.4	STREET FLOW
45		17.0	25.2	FLOW IN STORM SEWER
45a		8.0	30.6	STREET FLOW
46		24.9	40.0	FLOW IN STORM SEWER



KEY MAP
NO SCALE



SCALE: 1"=80'

CORE ENGINEERING GROUP
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PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
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NO.	DESCRIPTION	DATE

PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVE., SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD – WALLEYE DRIVE
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

DEVELOPED CONDITIONS THE HILLS AT LORSON RANCH C10 and C12 BASINS

DATE
OCT 22, 2020

PROJECT NO.
100.061

SHEET NUMBER
1

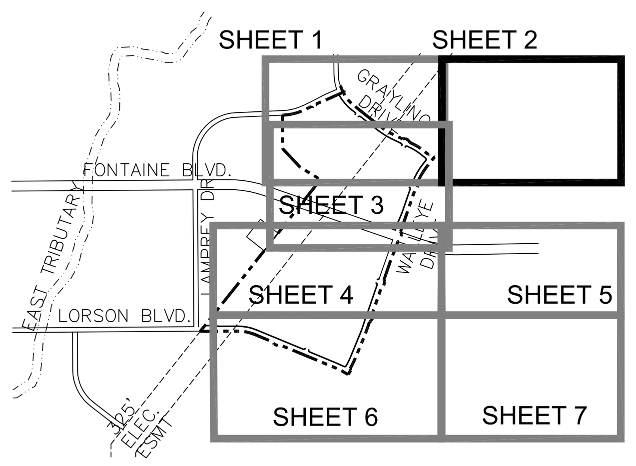
TOTAL SHEETS: 7

LEGEND

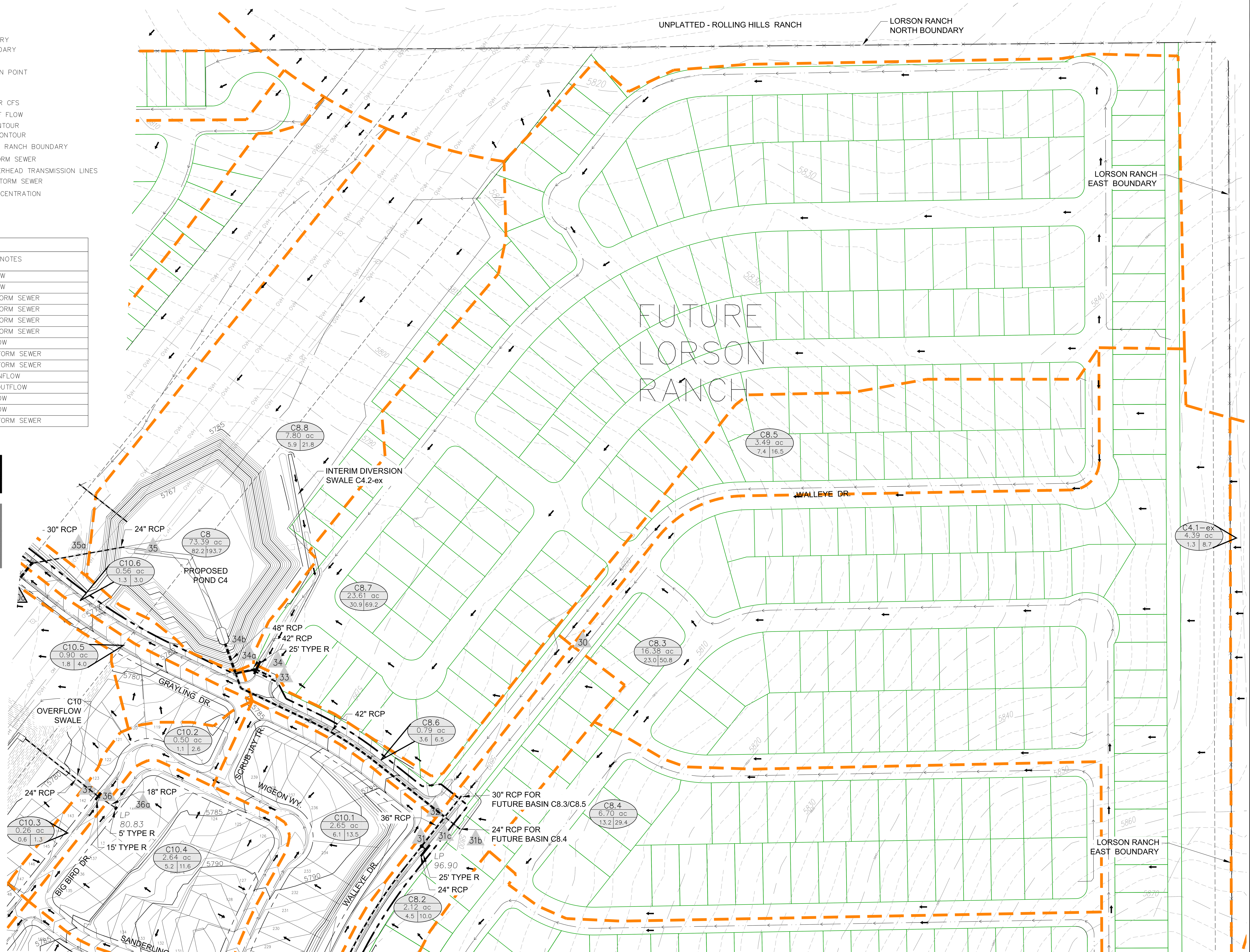
PUD BOUNDARY
BASIN BOUNDARY
BASIN DESIGN POINT
DENOTES OVERALL BASIN — BASIN I.D. / ACREAGE / 5 YR/100 YR CFS (BASIN / XX AC / X.X / X.X)
DIRECTION OF FLOW
6690 EXISTING CONTOUR
6670 PROPOSED CONTOUR
ROW/LORSON RANCH BOUNDARY
EXISTING STORM SEWER
OVH EXISTING OVERHEAD TRANSMISSION LINES
PROPOSED STORM SEWER
TIME OF CONCENTRATION
HP HIGH POINT
LP LOW POINT

RUNOFF SUMMARY

D.P.	5 YEAR cfs	100 YEAR cfs	NOTES
30	24.3	59.4	STREET FLOW
31	14.5	30.0	STREET FLOW
31b	13.2	29.4	FLOW IN STORM SEWER
31c	23.4	50.9	FLOW IN STORM SEWER
32	45.1	105.4	FLOW IN STORM SEWER
33	7.3	15.3	FLOW IN STORM SEWER
34	30.9	69.2	STREET FLOW
34a	38.2	84.5	FLOW IN STORM SEWER
34b	83.3	189.9	FLOW IN STORM SEWER
35	131.6	277.0	POND C4 INFLOW
35a	16.5	43.7	POND C4 OUTFLOW
36a	5.2	11.6	STREET FLOW
36	7.2	18.2	STREET FLOW
37	12.4	27.5	FLOW IN STORM SEWER



KEY MAP
NO SCALE



SEE SHEET 1

SEE SHEET 3

SEE SHEET 5

CORE ENGINEERING GROUP
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BURNSVILLE, MN 55306
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CONTACT: RICHARD L. SCHINDLER, P.E.
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NO. | DESCRIPTION | DATE

PREPARED FOR:
LORSON, LLC
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COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD – WALLEYE DRIVE
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

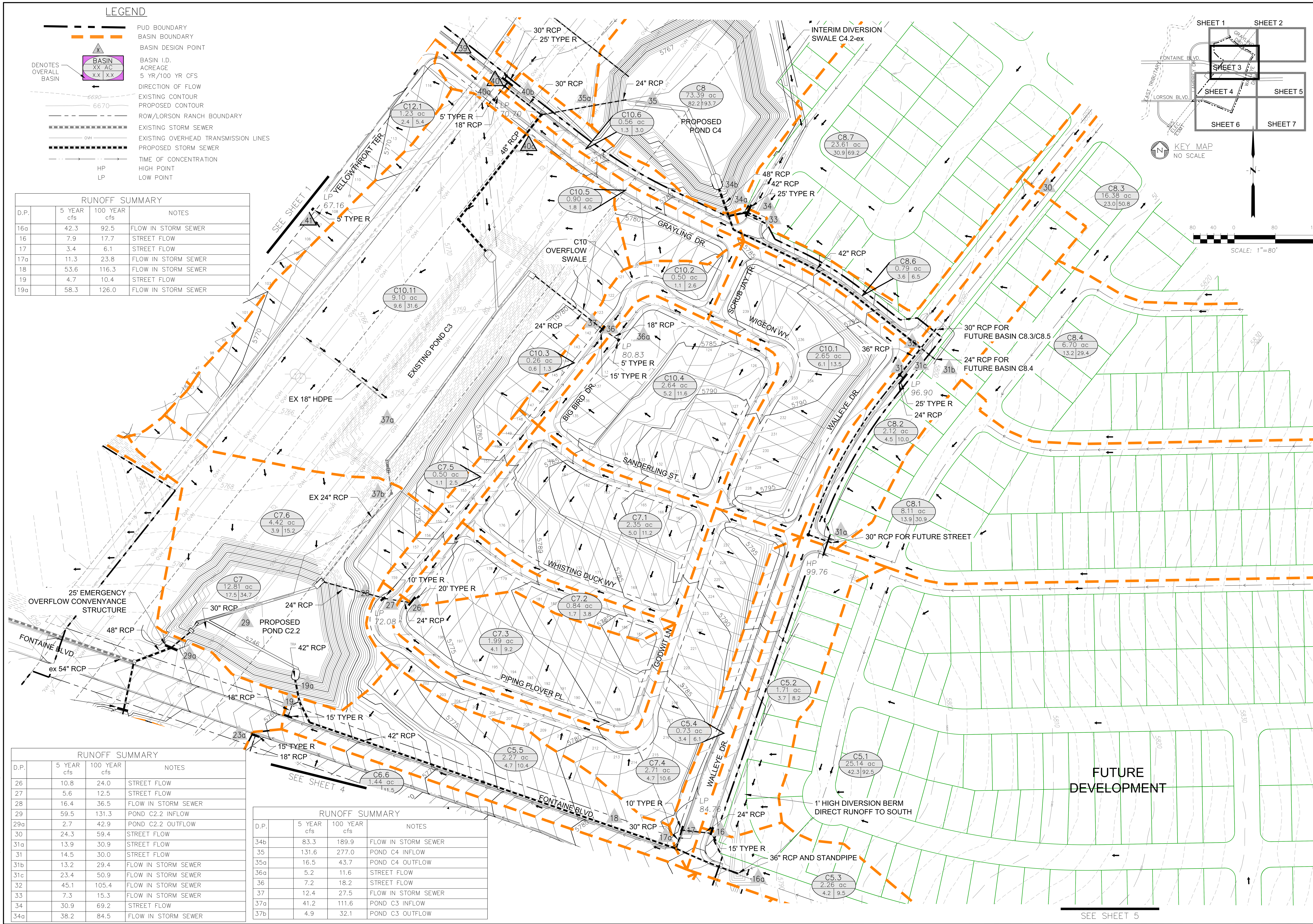
DEVELOPED CONDITIONS
THE HILLS AT LORSON RANCH
C8 BASINS

DATE
OCT 22, 2020

PROJECT NO.
100.061

SHEET NUMBER
2

TOTAL SHEETS: 7



RUNOFF SUMMARY				
D.P.		5 YEAR cfs	100 YEAR cfs	NOTES
16a		42.3	92.5	FLOW IN STORM SEWER
16		7.9	17.7	STREET FLOW
17		3.4	6.1	STREET FLOW
17a		11.3	23.8	FLOW IN STORM SEWER
18		53.6	116.3	FLOW IN STORM SEWER
19		4.7	10.4	STREET FLOW
19a		58.3	126.0	FLOW IN STORM SEWER

RUNOFF SUMMARY				
D.P.		5 YEAR cfs	100 YEAR cfs	NOTES
26		10.8	24.0	STREET FLOW
27		5.6	12.5	STREET FLOW
28		16.4	36.5	FLOW IN STORM SEWER
29		59.5	131.3	POND C2.2 INFLOW
29a		2.7	42.9	POND C2.2 OUTFLOW
30		24.3	59.4	STREET FLOW
31a		13.9	30.9	STREET FLOW
31		14.5	30.0	STREET FLOW
31b		13.2	29.4	FLOW IN STORM SEWER
31c		23.4	50.9	FLOW IN STORM SEWER
32		45.1	105.4	FLOW IN STORM SEWER
33		7.3	15.3	FLOW IN STORM SEWER
34		30.9	69.2	STREET FLOW
34a		38.2	84.5	FLOW IN STORM SEWER

RUNOFF SUMMARY				
D.P.		5 YEAR cfs	100 YEAR cfs	NOTES
34b		83.3	189.9	FLOW IN STORM SEWER
35		131.6	277.0	POND C4 INFLOW
35a		16.5	43.7	POND C4 OUTFLOW
36a		5.2	11.6	STREET FLOW
36		7.2	18.2	STREET FLOW
37		12.4	27.5	FLOW IN STORM SEWER
37a		41.2	111.6	POND C3 INFLOW
37b		4.9	32.1	POND C3 OUTFLOW

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NO. | DESCRIPTION | DATE

PREPARED FOR: LORSON, LLC
212 N. WAHSATCH AVE., SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT: THE HILLS AT LORSON RANCH
FONTAINE BLVD — WALLEYE DRIVE
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

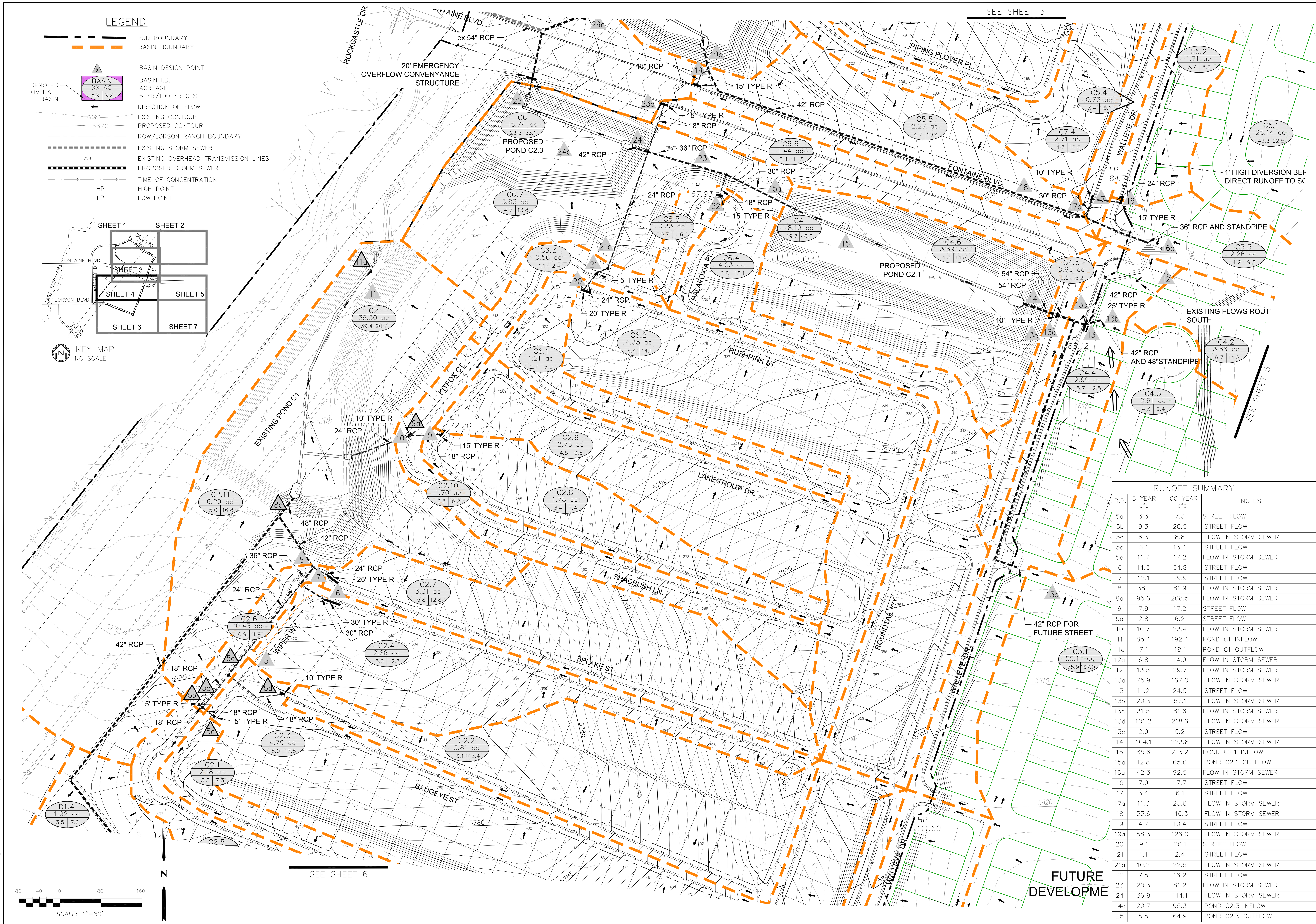
DEVELOPED CONDITIONS
THE HILLS AT LORSON RANCH
C5, C7 and C10 BASINS

DATE
OCT 22, 2020

PROJECT NO.
100.061

SHEET NUMBER
3

TOTAL SHEETS: 7



RUNOFF SUMMARY			
D.P.	5 YEAR cfs	100 YEAR cfs	NOTES
5a	3.3	7.3	STREET FLOW
5b	9.3	20.5	STREET FLOW
5c	6.3	8.8	FLOW IN STORM SEWER
5d	6.1	13.4	STREET FLOW
5e	11.7	17.2	FLOW IN STORM SEWER
6	14.3	34.8	STREET FLOW
7	12.1	29.9	STREET FLOW
8	38.1	81.9	FLOW IN STORM SEWER
8a	95.6	208.5	FLOW IN STORM SEWER
9	7.9	17.2	STREET FLOW
9a	2.8	6.2	STREET FLOW
10	10.7	23.4	FLOW IN STORM SEWER
11	85.4	192.4	POND C1 INFLOW
11a	7.1	18.1	POND C1 OUTFLOW
12a	6.8	14.9	FLOW IN STORM SEWER
12	13.5	29.7	FLOW IN STORM SEWER
13a	75.9	167.0	FLOW IN STORM SEWER
13	11.2	24.5	STREET FLOW
13b	20.3	57.1	FLOW IN STORM SEWER
13c	31.5	81.6	FLOW IN STORM SEWER
13d	101.2	218.6	FLOW IN STORM SEWER
13e	2.9	5.2	STREET FLOW
14	104.1	223.8	FLOW IN STORM SEWER
15	85.6	213.2	POND C2.1 INFLOW
15a	12.8	65.0	POND C2.1 OUTFLOW
16a	42.3	92.5	FLOW IN STORM SEWER
16	7.9	17.7	STREET FLOW
17	3.4	6.1	STREET FLOW
17a	11.3	23.8	FLOW IN STORM SEWER
18	53.6	116.3	FLOW IN STORM SEWER
19	4.7	10.4	STREET FLOW
19a	58.3	126.0	FLOW IN STORM SEWER
20	9.1	20.1	STREET FLOW
21	1.1	2.4	STREET FLOW
21a	10.2	22.5	FLOW IN STORM SEWER
22	7.5	16.2	STREET FLOW
23	20.3	81.2	FLOW IN STORM SEWER
24	36.9	114.1	FLOW IN STORM SEWER
24a	20.7	95.3	POND C2.3 INFLOW
25	5.5	64.9	POND C2.3 OUTFLOW

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COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD - WALLEYE DRIVE
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

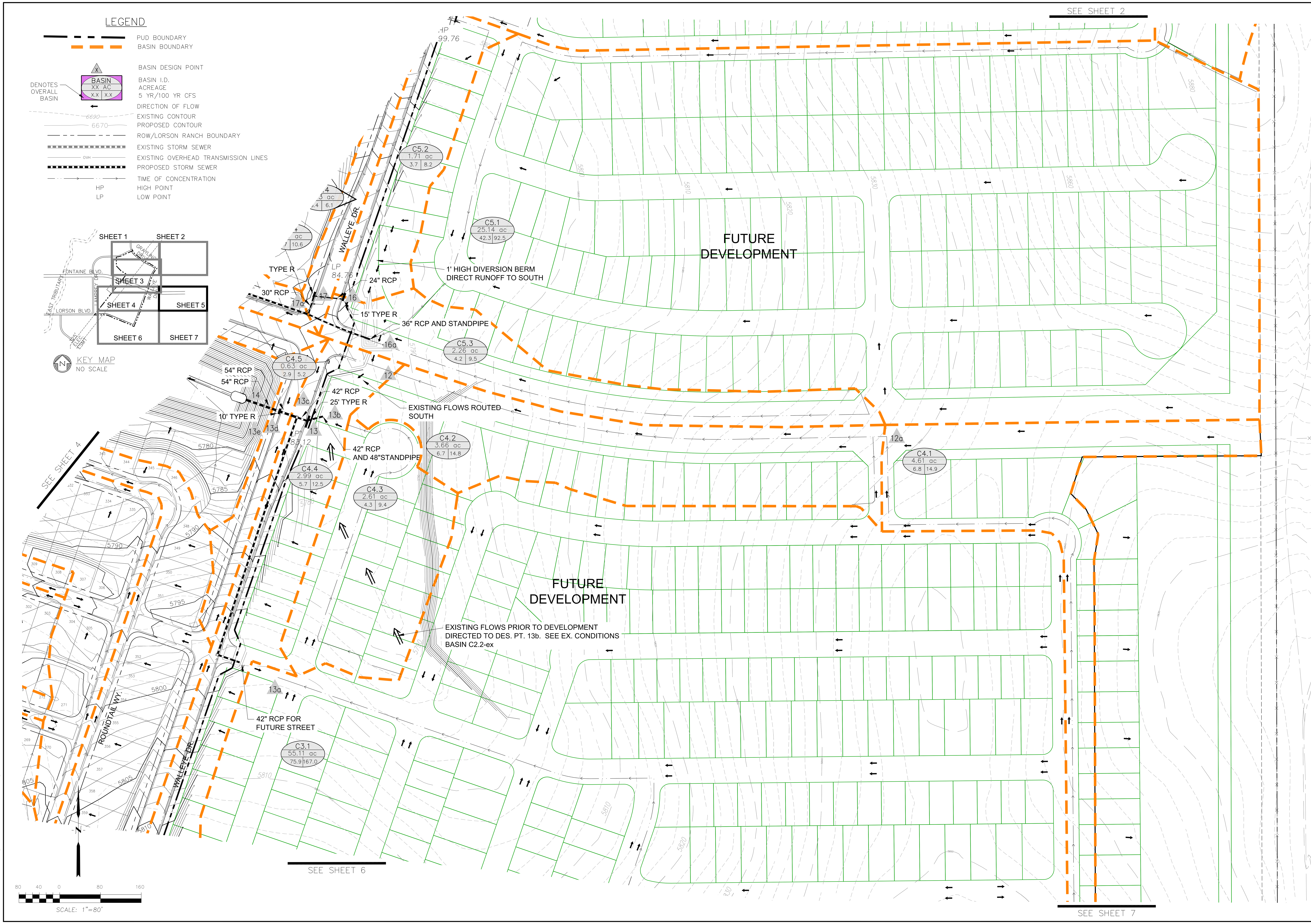
DEVELOPED CONDITIONS
THE HILLS AT LORSON RANCH
C2, C4 and C6 BASINS

DATE
OCT 22, 2020

PROJECT NO.
100.061

SHEET NUMBER
4

TOTAL SHEETS: 7



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(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
THE HILLS AT LORSON RANCH
FONTAINE BLVD – WALLEYE DRIVE
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

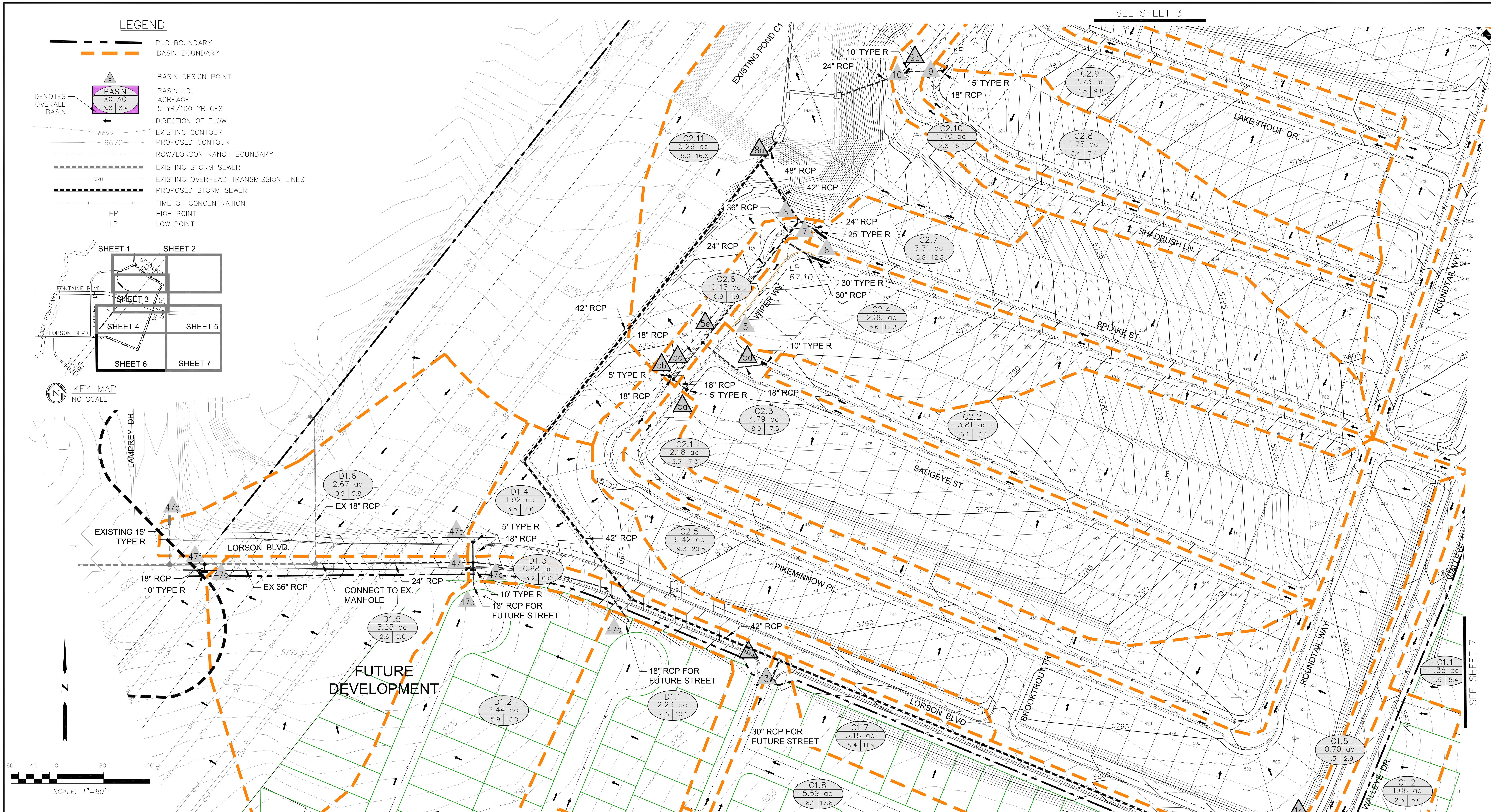
DEVELOPED CONDITIONS
THE HILLS AT LORSON RANCH
C3 and C4 BASINS

DATE
OCT 22, 2020

PROJECT NO.
100.061

SHEET NUMBER
5

TOTAL SHEETS: 7



RUNOFF SUMMARY			
D.P.	5 YEAR cfs	100 YEAR cfs	NOTES
1a	12.8	28.3	FLOW IN STORM SEWER
1	4.8	20.3	STREET FLOW
1b	37.1	75.3	FLOW IN STORM SEWER
1c	1.3	3.0	STREET FLOW
2	6.1	23.3	FLOW IN STORM SEWER
2a	43.2	88.6	FLOW IN STORM SEWER
3	14.3	38.0	STREET FLOW
4	57.5	126.6	FLOW IN STORM SEWER
5a	3.3	7.3	STREET FLOW
5b	9.3	20.5	STREET FLOW
5c	6.3	8.8	FLOW IN STORM SEWER
5d	6.1	13.4	STREET FLOW
5e	11.7	17.2	FLOW IN STORM SEWER
6	14.3	34.8	STREET FLOW
7	12.1	29.9	STREET FLOW
8	38.1	81.9	FLOW IN STORM SEWER

RUNOFF SUMMARY			
D.P.	5 YEAR cfs	100 YEAR cfs	NOTES
8a	95.6	208.5	FLOW IN STORM SEWER
9	7.9	17.2	STREET FLOW
9a	2.8	6.2	STREET FLOW
10	10.7	23.4	FLOW IN STORM SEWER
47a	4.6	10.1	FLOW IN STORM SEWER
47b	5.9	13.0	FLOW IN STORM SEWER
47c	3.2	6.0	STREET FLOW
47d	3.5	7.6	STREET FLOW
47	16.18	32.11	FLOW IN STORM SEWER
47e	2.6	9.56	STREET FLOW
47f	20.88	43.96	FLOW IN STORM SEWER
47g	1.92	9.83	STREET FLOW

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NO. | DESCRIPTION | DATE

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(719) 635-3200
CONTACT: JEFF MARK

PROJECT: THE HILLS AT LORSON RANCH
FONTAINE BLVD – WALLEYE DRIVE
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

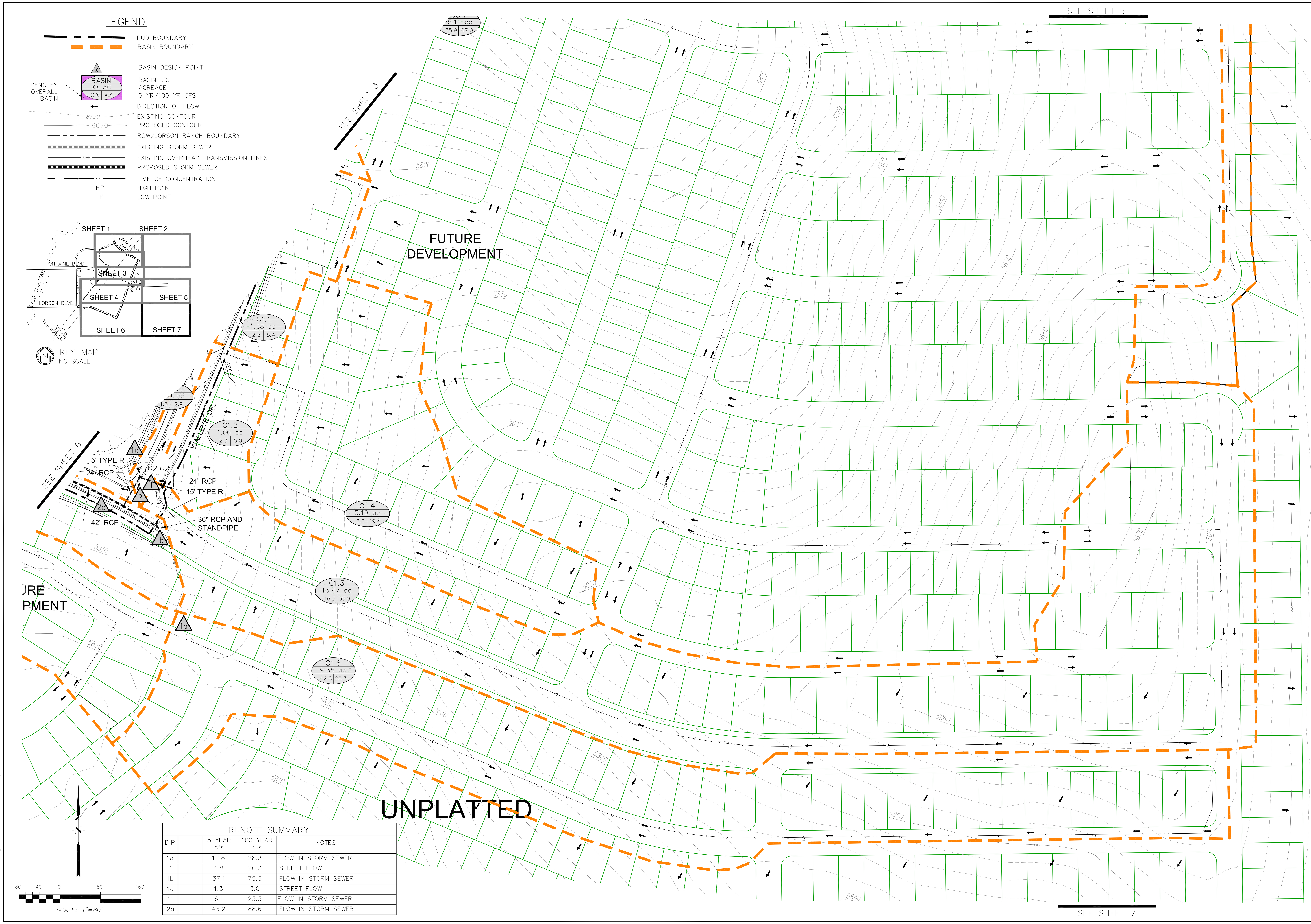
DEVELOPED CONDITIONS
THE HILLS AT LORSON RANCH
C1, C2 and D1 BASINS

DATE
OCT 22, 2020

PROJECT NO.
100.061

SHEET NUMBER
6

TOTAL SHEETS: 7



RUNOFF SUMMARY			
D.P.	5 YEAR cfs	100 YEAR cfs	NOTES
1a	12.8	28.3	FLOW IN STORM SEWER
1	4.8	20.3	STREET FLOW
1b	37.1	75.3	FLOW IN STORM SEWER
1c	1.3	3.0	STREET FLOW
2	6.1	23.3	FLOW IN STORM SEWER
2a	43.2	88.6	FLOW IN STORM SEWER

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(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
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FONTAINE BLVD – WALLEYE DRIVE
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

DEVELOPED CONDITIONS THE HILLS AT LORSON RANCH C1 BASINS

DATE
OCT 22, 2020

PROJECT NO.
100.061

SHEET NUMBER
7

TOTAL SHEETS: 7